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ABSTRACT

The first part of the case study describes the establishment of kilns to produce fired bricks in the Luristan region of Iran and utilization of local skills and resources to meet local needs. The emphasis is on providing job opportunities to supplement the existing agricultural economic base and on supporting the local building industry, both of which are an essential part of the development of a region suffering from seasonal migration. The success of these new industries depends upon the acceptance and involvement of the local community; it is insufficient to set up production units without ensuring the participation of the people who are to operate it in the future. The second portion examines the existing tile production industry in the Caspian region, which is facing increasing competition from new materials, with a consequent threat to local jobs. In this case, the approach is to reorganize processes involved in tile production for greater efficiency and profit while maintaining the labour intensive nature of production units to ensure continuance of local employment opportunities. The final section reports the building of schools and other public buildings in Selseleh, also through the use of local skills and materials. (Author/NEC)

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IRAN:

A CASE STUDY ON STIMULATION AND IMPROVEMENT OR ESTABLISHMENT OF LOCALLY-BASED MATERIALS OR ELEMENTS PRODUCTION, IN THE LURISTAN & CASPIAN REGIONS.

by

John Norton

Division of
Educational Policy and Planning

Unesco, Paris

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FOREWORD

Unesco's General at its 19th session (Nairobi, Kenya, 1976) resolved that the Secretariat give particular attention to "gathering and disseminating information about new educational policies for the renewal of educational systems adapted to specific needs on the basis of particular social, economic and cultural situations and aimed at promoting democratization of the systems within the framework of life-long education" (Programme Resolution 1.111).

In line with this mandate the Division of Educational Policy and Planning began in 1977 reproducing selected technical papers and distributing them as a series under the general title: "Reports Studies...". The aim of this series is to stimulate reflection and discussion on current issues confronting educational policy-makers, planners, administrators and school architects. Distribution is limited to Unesco officials at Headquarters and in the field as well as interested technical personnel in governmental and private institutions. It is hoped that this series will promote and serve as a vehicle for increasing communication between individuals and institutions concerned with policy and planning aspects of education.

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La Conférence Générale de l'Unesco, lors de sa 19e session (Nairobi, Kenya, 1976) a décidé que "la collecte et la dissémination de l'information sur les nouvelles politiques d'éducation pour le renouvellement et la réforme des systèmes d'éducation adaptés aux besoins spécifiques basés sur des situations sociales, économiques et culturelles particulières et qui ont comme objectif la démocratisation des systèmes dans le cadre de l'éducation permanente" (Résolution 1.111 du programme) se situent parmi les objectifs prioritaires de l'Organisation.

Conformément à ce mandat, la Division des politiques et de la planification de l'éducation a entrepris en 1977 la reproduction et la distribution de certains documents techniques, sous le titre général de "Rapports et Etudes..." Cette série a pour objet de stimuler la réflexion et les discussions portant sur les problèmes courants auxquels douvent faire face les décideurs, les planficateurs et les administrateurs de l'éducation ainsi que les architectes scolaires. La distribution de limite aux professionnels du Siège et hors-Siège, ainsi qu'aux personnels d'institutions gouvernementales ou privées susceptibles de les trouver utiles pour leur travail. Nous espérons que cette série constituera un moyen pour promouvoir et augmenter la communication entre les individus et les institutions concernés par les différents aspects des politiques et de la planification de l'éducation.

- -

La Conferencia General de la Unesco, en su 19a. sesión (Nairobi, Kenya 1976) resolvió que la Secretaría prestara un atención particular al acopio y la difusión de informaciones relativas a las nuevas políticas educativas para la renovación y reforma de los sistemas de educación adaptadas a las necesidades nacionales específicas basadas en las situaciones sociales, económicas y culturales particulares y destinadas a promover la democratización de esos sistemas dentro del marco de la educación permanente. (Resolución 1.11 del program).

En conformidad a ese mandato la División de Políticas y Planificación de la Educación comenzo en 1977 a reproducir trabajos técnicos seleccionados, y a difundirlos en una serie, que tiene el título genérico de "Informes y Estudios". La finalidad de esta serie consiste en estimular la reflexión y la discusión sobre problemas corrientes que deben afrontan los que toman decisiónes, los planificadores y administradores de la educación así como los arquitectos especialistas en construcciones escolares. La distribución de esta serie está limitada a los especialistas de la Unesco, en la Sede y en el terreno, así como el personal de instituciones gubernamentales y privadas para los que ésta puede ser de cierta utilidad. Se espera que está puede ser de cierta utilidad. Se espera que está serie promueva y sirva de medio para la comunicación entre especialistas e instituciones relacionados con los distintos aspectos de la política y el planeamiento de la Educación.

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

SUMMARY

The first part of the case study, in the Luristan region, deals with the setting up of the kilns in the area and with making use of local skills and resources to meet local needs. The emphasis is on providing job opportunities to supplement the existing agricultural economic base and on supporting the local building industry, both of which are an essential part of the development of a region which suffered from seasonal migration. The study points out that the success of these industries depends primarily upon the acceptance and involvement of the local community and that it is insufficient to set up production units without ensuring the participation of the people who are to operate it in the future.

The second part of the study, in the Caspian region, looks at the existing tile production industry which is facing increasing competition from new materials with a consequent threat to jobs in the area. In this case, the approach is to reorganize the processes involved in tile production so that the production becomes more efficient and profitable. At the same time, the essentially labour intensive nature of the production units is maintained to ensure that local employment opportunities are not lost.

The last part of the study deals with the building of schools and other public buildings in Selseleh, also through the use of local skills and materials.

R E S U M E

La première partie de l'étude de cas relative à la région du Louristan concerne l'installation de fours et l'utilisation des ressources humaines et matérielles locales pour faire face aux besoins. L'accent est mis sur les possibilités de créer des emplois complétant l'économie agricole existante et d'apporter un soutien à l'industrie locale du bâtiment, ces deux activités représentant la base essentielle du développement d'une région qui était jusqu'alors victime de migrations saisonnières. L'étude souligne que la réussite de ces industries dépend en premier lieu de l'acceptation et de l'intérêt de la communauté locale et qu'il n'est pas suffisant de mettre en place des unités de production si l'on n'obtient pas la participation des gens qui en assureront ultérieurement le fonctionnement.

La seconde partie de l'étude relative à la région caspienne examine l'industrie existante de production de tuiles qui doit faire face à la concurrence de plus en plus dure des nouveaux matériaux qui constitue une menace pour l'emploi dans la région. Dans ce cas, la solution envisagée consiste à réorganiser les méthodes de production des tuiles afin d'améliorer la rentabilité. En même temps, la nature de la production, qui repose essentiellement sur le facteur humain, est maintenue afin d'éviter que les possibilités locales d'emploi ne disparaissent.

La dernière partie de l'étude concerne la construction d'écoles et autres bâtiments publics à Selseleh grâce à l'utilisation de la main d'oeuvre et des matériaux locaux.

CONTENTS

		Page
A.	Selseleh, Luristan	1
B.	Caspian region	10
C.	Public buildings in Selseleh	29

Contents

A Selseleh, Luristan, Iran

A.1	Introduction	Page 1
A.2	Existing supplies and resources	1
A.3	Planning and village organisation	2
A.4	Kilns	5
A.5	Woodworking and metal working	8
A.6	Conclusion	9

Illustrations

Fig. A.1	Location of Selseleh in Iran	Page 3
A.2	The Selseleh Basin	3
A.3	Kiln in Kamarsian	7

STIMULATION AND IMPROVEMENT OR ESTABLISHMENT OF LOCALLY BASED MATERIALS OR ELEMENTS PRODUCTION

A SELSELEH, LURISTAN, IRAN

A.1 Introduction

As an inherent part of providing means to achieve appropriate building solutions and methods where local builders and the population in general have control over the provision of the shelter needs, it is not sufficient to simply ensure that there are people capable of meeting these needs, and that they are conversant with a range of different requirements and solutions. Trained builders and artisans (see Builders Training Workshop Case Study), must be backed up by a variety of production units providing those elements and items which are not available in a natural state locally. This covers a wide range of activities. The case study of this aspect of the work carried out by the Selseleh Integrated Development Project (S.I.D.P.) in Luristan, Iran, is a useful example of some of the things that can be done and some of the problems that one can expect to face in their implementation.

One of the aims of the S.I.D.P. was to make as much use as possible of the locally available resources, and at the same time, create more and alternative job opportunities, thus strengthening the economic base of the region. This approach covered agriculture and handicrafts as well as items more directly related to the local building industry.

A.2 Existing supplies and resources.

At the time that the S.I.D.P. programme was set up, the use of building materials fell into two basic categories: materials immediately available in the region, used largely

in an unprocessed state; mud, timber, sand and some stone; and materials brought in from outside, most of which had been through some form of processing before arriving in the area; these included fired bricks, lime, cement, steel and some timber (particularly sawn timber.) Some of these materials had to be transported by truck for considerable distances and over extremely poor roads. The extra cost of transport was extremely high, and in the case of fired bricks which were normally brought from Malayer (see Map Fig. A.1), a distance of 200 kms, the transport cost was 100% extra on the cost of the bricks. Additionally, difficult road conditions, often in poor weather, made these deliveries unreliable. Nationally there were shortages of certain materials at various times (e.g. bricks or cement) which further hampered the possibilities of completing buildings during the dry period of the year when most building took place (May to October).

Within the Selseleh Region there were a number of natural resources, and the potential for producing more, for example by re-aforestation. The natural resources included limestone, clayey soils, sand, plentiful supplies of water and scattered deposits of chalk. These materials formed the basis for providing a range of local building materials at low cost and that could be easily used by the local population.

A.3 Planning and village organisation

The first steps to be taken in setting up new or improved production industries were to find out what materials were available and what skills also available for the various processes that these materials required, and finally to find the best sites for setting up these industries. This depended upon the exact locality of raw mat-

Fig A1

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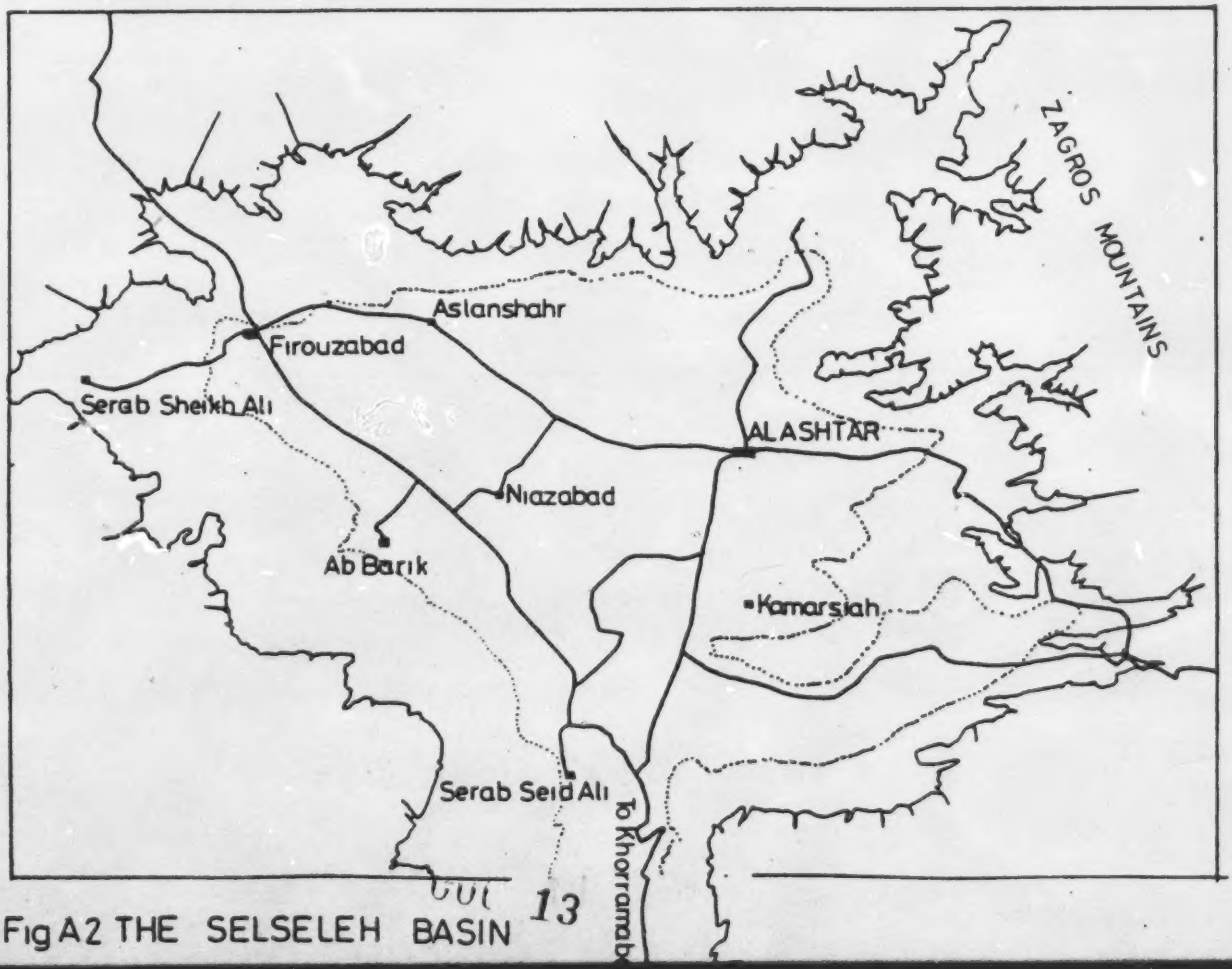

Fig A2 THE SELSELEH BASIN

erials, ease of access for collection and deliveries and the availability of people ready to participate in the new activity.

The still predominantly feudal structure of many of the villages in the area made the proper organisation of labour and management essential since the intention was to set up a system that would be devolved to the total control of the community after the initial setting up period by the S.I.D.P. This was closely linked to the other activities of the S.I.D.P. The trainee health, agriculture and education team, who were initially paid for by the S.I.D.P., would in future by paid for by the community that they served.

SERAB SHEIKH ALI

The relationship developed for the village of Serab Sheik Ali (Fig. A.2) illsutrates the broad principle.

In the village the three front line workers who had been trained by the S.I.D.P. were based in a collective building, providing a small clinic, teaching space and storage for agricultural items, such as seeds. Adjacent to this was a small experimental agricultural plot. The task of the front line workers in addition to their basic trained skills, i.e. health work, was to stimulate and assist local productive activities such as weaving, and to help in the establishment of public services in the village.

A brick kiln was also set up outside the village by the S.I.D.P. The kiln provided work for labourers in the village who owned no land and/or were working seasonally. The front line workers had organisational and financial responsibility for the kiln, whilst they were not actually in charge of its practical running. Profit from the

kiln pays for the font line workers, who are now in effect supported by the efforts of the village, and any extra profit is channelled into providing new required facilities, hence providing direct benefit to the whole community.

A.4 Kilns

After discussion with local builders in the Selseleh Region, it was decided that a selection of kilns should be set up to produce fired bricks, lime and chalk for building. One of the older builders had had some experience in operating a kiln in the past and there were remains of kilns in the area, around Alashtar.

Because the smoke from the kiln would pollute the air, locating it near to Alashtar, the regional centre (Fig.A.2) was decided against. In addition, Alashtar was also attracting more investment and therefore more job opportunities, whilst in part the aim of the small scale industries programme was to provide better opportunities in the villages.

Several sites were visited to find out their suitability for setting up a kiln and to see whether the roads leading to them could be used by small lorries. Soil samples were taken at each site and tested to see whether they were suitable for brick making. After a basic selection, second visits were made to chosen sites to discuss with the locals the availability of water and who would be interested in working at the kiln if it was set up.

Finally, for the first kiln, the village of Kamarsiah (Fig. A.2) was chosen. Water to the kiln site was available in an open channel on a shared basis with the needs of the agricultural land nearby. This water was used to

fill a reservoir on the site. Later, because of agricultural demand, this water supply became too unreliable and it was necessary to dig a well. It would have been better to do this at the beginning.

Two updraught kilns were built, using the traditional design of the area (Fig. A.3), using oil for fuel, which was cheap (subsidised in Iran) and easy to obtain. The usual method of firing kilns in the general area is to have a small reservoir - 200 litres - from which a pipe supplies a drip feed into the firing chamber. This is difficult to regulate and inefficient. As the oil level drops, so the frequency of drips also decreases. Oil falls onto the floor of the firing chamber where it burns. In the new kilns a large fuel reservoir was built, providing enough head to introduce fuel into the firing chamber under pressure. This results in a finer distribution of fuel and more efficient combustion. The constant pressure from the reservoir makes the system easier to regulate and control.

Several problems hampered the smooth operation of these two kilns. Whilst the villagers had been enthusiastic about acquiring a source of income as an alternative or supplement to the local agricultural and animal husbandry potential, in practice they were nervous of committing themselves to the new kilns. Each time that temporary work was required, all the labour would disappear from the kiln, since they feared that they would not be employed in the fields again if they failed to turn up, and equally believed that, after the S.I.D.P. contribution and control was removed, the kiln would not support them financially, and there would be nothing else to turn to. This situation was unfortunately encouraged by one of the landlords in the village, who feared that his cheap supply

Fig A3 KILN IN KAMARSIAH

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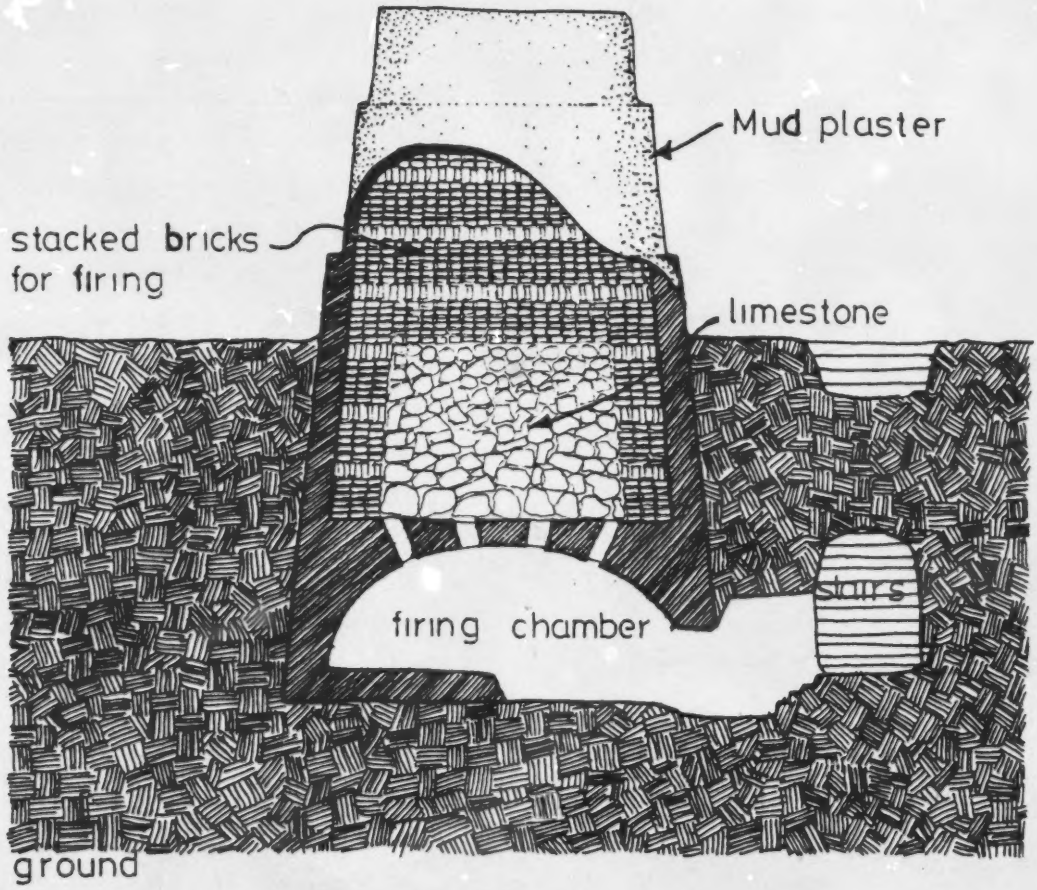

CUT AWAY SECTION

METRES

0 1 2 3 4 5

of labour was being eroded.

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Because the workers on the kiln were constantly changing, it was difficult to develop a team who could operate responsibly and carefully. This resulted in poor quality and productivity: the soil on the site was suitable for fired brick production but occasionally contained small lumps of lime which had to be removed. The process for removing them was simple (by seiving and sedimentation pits) but was often not performed rigorously. Batches of bricks were produced with lime in them, and were therefore unusable. Without improvement in the quality of production, the kiln would in effect not pay for itself, and the fears of the villagers would be justified. To avoid this and to allow confidence to develop that the kiln was of value to the village, one of the kilns was switched to lime production, using limestone from adjacent hillsides. This was a very much easier process, required much less skill and the product was guaranteed to be saleable.

Problems varied between villages. The brick kiln set up at Serab Sheikh Ali was more successful than Kamarsiah, and was largely a reflection of the attitued held by the people in the village towards a scheme of this sort.

A.5 Woodworking and metalworking

Public building in the Region generated new needs and possible productive activities. Previously, the existing public baths in the area used boilers made elsewhere. With the building of new public baths the possibility developed for making boilers in Alashtar, which would save money and help the small metalworkers in the town. Based on a prototype brought from Hamadan for the first public bath, several hot water boilers were built in

Alashtar for the village public baths. All the work was done in a metal working shop run by the S.I.D.P., using local apprentices. Apart from the cheaper cost, the main advantage over the old boilers was that in future any repair and maintenance work could be done locally. This same workshop also built a number of solar collectors, developed for use heating water on the village public baths.

In Alashtar there was also a small vocational workshop equipped with carpentry machinery, but which had no practical work to do. At the same time, wooden doors and windows were brought from Khorramabad, the provincial capital. It was logical to give this work to the school, who were then able to get practical experience whilst the joinery needs in the S.I.D.P. assisted buildings were met locally. More elaborate work was undertaken as their skill increased.

A.6 Conclusion

Although the potential resources existed, it was often difficult to establish new industries where there had been no background in this type of work. It required considerable guidance and encouragement, after the initial setting up process, to develop the confidence needed for successful future operation. In this respect careful use of human resources was far more important than the use of material resources. It would have been insufficient to consider the programme purely in terms of providing the capital and basic skills needed to start up a production unit.

CASPIAN

Contents

B Caspian

		Page
B.1	Introduction	
B.2	Roofing - change and effect	13
B.3	Pan tile production	14
B.4	Improvements	18
B.5	Conclusions	21

Appendix 1. Notes on proofing materials comparative costs chart' and 'roofing materials comparative costs'.

Illustrations

			Page
Fig.	B.1	Caspian tile producing areas	12
	B.2	Pan tile	15
	B.3	Soil classification - mechanical analysis	17
	B.4	Tile kiln, Chubhar, Gilan	18
	B.5	Tile production unit, Chubhar	21
	B.6	Traditional tile production system organisation	22
	B.7	Improved production system	23
	B.8	Improved tile production system organisation	25

B CASPIAN

B.1 Introduction

Small scale industries in the Caspian Region of Iran (Location Fig. B.1) play an active part in the economy of the region. Small workshops and kilns are scattered throughout the area, processing timber into component parts for buildings and producing tiles for roofing. Brick kilns are less common nowadays but have been replaced by the viable activity of producing cement blocks. Nearly all these industries are catering for local demand, and are extremely susceptible to changes in the local economy and building methods. These are an important factor in understanding the condition of building material industries in the contemporary situation of the Caspian.

The traditional pattern of building in the Caspian Region makes good use of materials which are available in the immediate locality of the building. This means that there are a very wide range of different building types and materials, and material production sites have consequently catered for quite a small market area. Much of the local building was done by owner-builders and village assistance. Labour was usually paid for in kind, in terms of providing meals during the building process and helping your neighbour in turn when he required assistance. Two notable changes have occured in recent years: people have changed over to the system of paying money for labour, with an increased awareness of the amount of time involved in building resulting from this, and two materials which are widely regarded as being long lasting and relatively maintenance free, concrete block and galvanized sheet metal imported from outside the region, have been introduced into the area, and are generating a more unified style of building throughout the region. Of all the production sites that are flourishing, small yards employing 2 or 3

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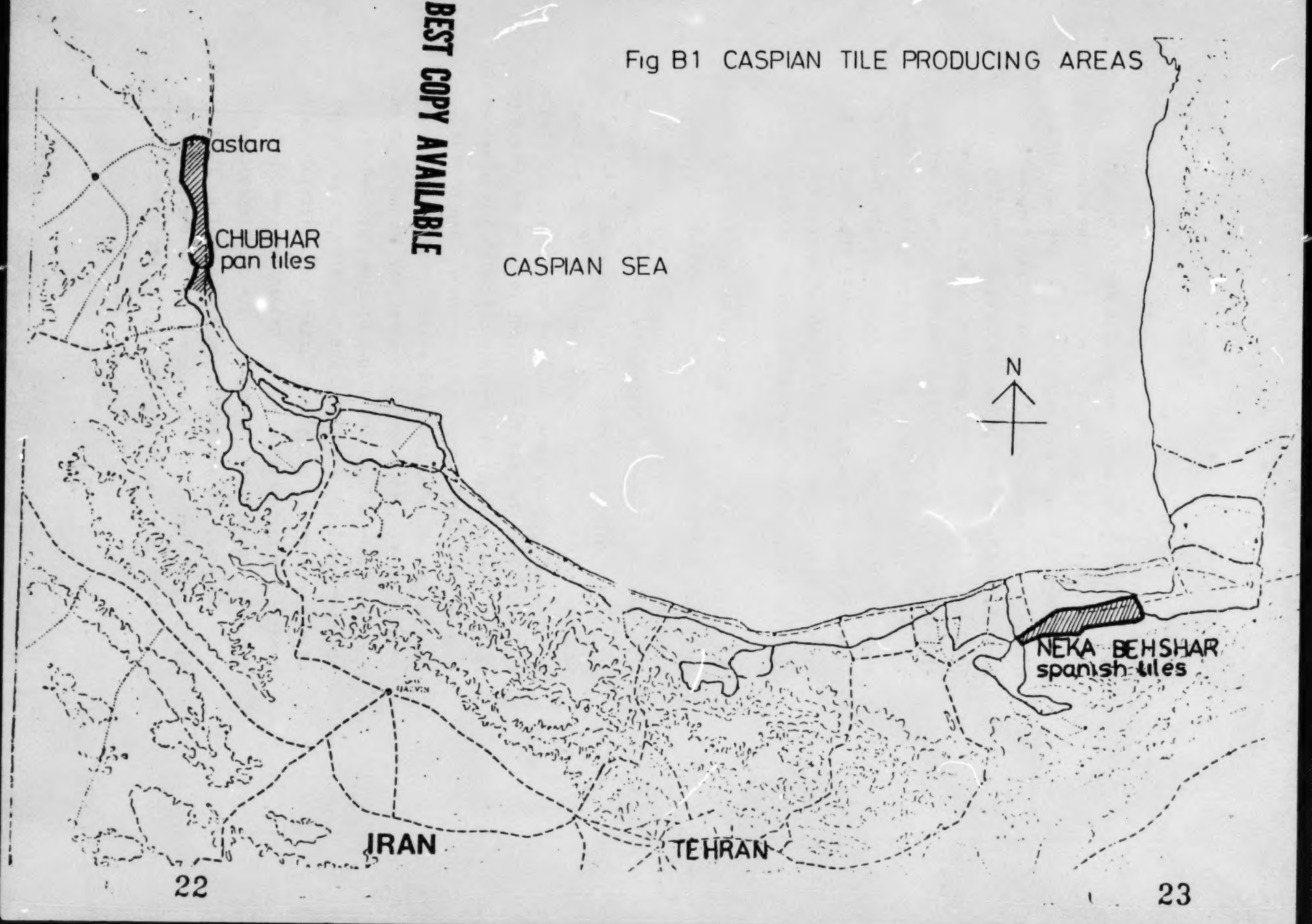
Fig B1 CASPIAN TILE PRODUCING AREAS



men to produce concrete blocks are the most common and successful. The more traditional materials, such as tiles for roofing, are often being spurned for the attractiveness of the new materials which are often somewhat erroneously believed to be longer lasting and maintenance free.

During the summer and autumn of 1978 Development Workshop conducted an extensive survey to ascertain what the condition of the rural building industry was in the area, what problems it faced and what could be done about it. The results of this survey, produced certain conclusions:*1 amongst which certain of them relate directly to the choice of building material and the methods by which those materials are produced and used.

B.2 Roofing - Change and Effect

The cost of roofing with galvanised sheet metal was, in 1978, an average of 10% more than the cost of roofing a similar space with 'Spanish' or 'Pan' tiles in the areas within which these latter materials are produced. *2
The life span of the sheet metal was no greater than the tiles, and the maintenance requirements were in come cases more. The 'Pan' tiles produced in the Astara region required practically no maintenance. Furthermore, people living in houses roofed with sheet metal, whilst admitting that the material had a prestige value, pointed out that their roofs were poor insulators, transferring extremes of temperature to the interior rendering them unsuitable

*1 Produced in full in: DARAIE. M.R; CAIN. A; NORTON. J; AFSHAR. F; INDIGENOUS BUILDING OF THE CASPIAN REGION Tehran, Iranian Institute for Peasant & Rural Studies 1979. Limited Edition. 457 pages. Text, illustrations.

*2 See Appendix 1 for comparative costs of roofing materials in Caspian Region.

for food storage, a popular practice in the houses with tile or thatch roofs found in the area. They also complained that the metal roofs were poor accoustically and that during rain storms the noise on the roof was considerable. Weighed against this were the attractions of prestige and the relative simplicity of putting up the sheet metal roof.

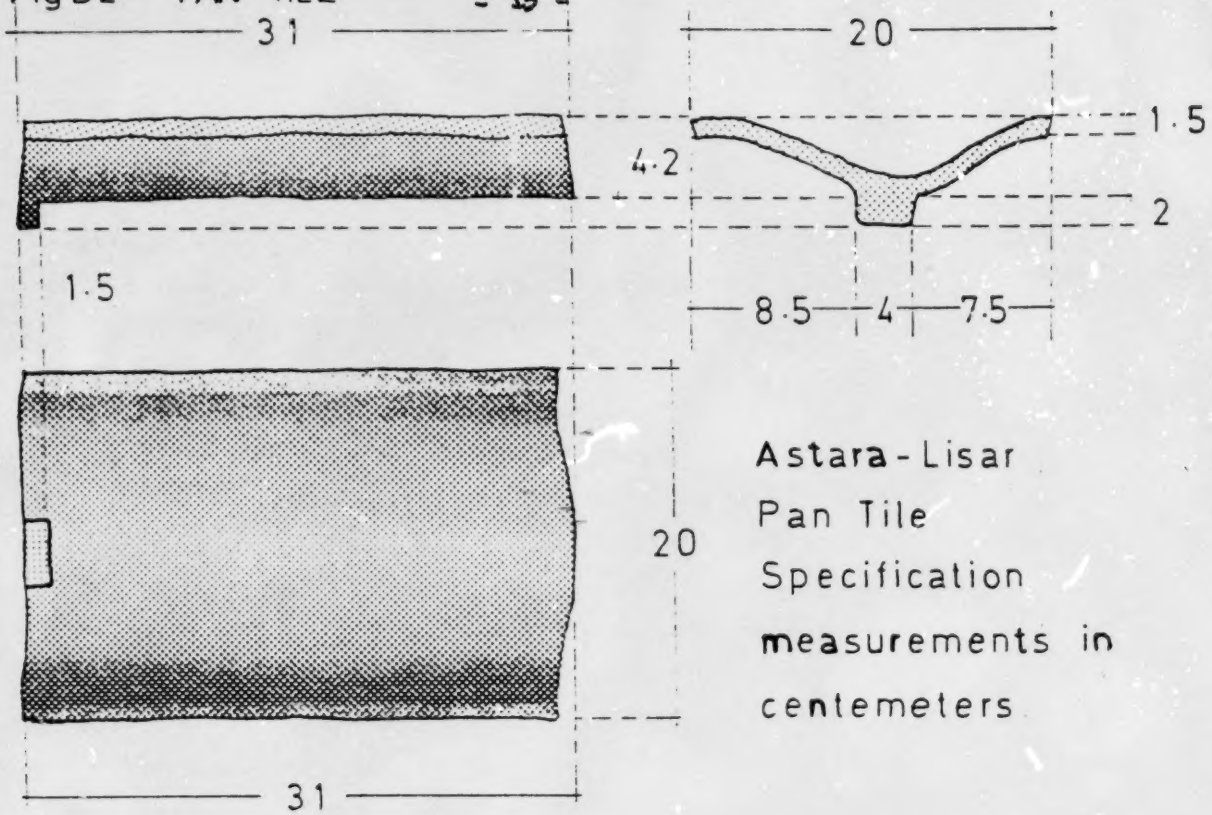
The conclusion drawn from this was that, albeit there are advantages in using tiles or thatch, the sheet metal roofs are gaining in popularity and use.

This has had the effect that tile kilns which previously operated at a small profit, in losing custom, have ceased to be economical and have gone out of business in all areas except for the kilns around Astara. In consequence, job opportunities have been lost, forcing people to migrate to other areas, local resources are not being used, and valuable capital is being spent outside the region, instead of stimulating and circulating within the local economy.

Of the different tile producing areas, it was concluded that for the Neka/Behshar area the market still existed for tiles, if they could be produced at lower cost, and that in the Astara area the tile industry, whilst still being active, could greatly improve in terms of efficiency, and by lowering the costs, could cater for a wider market area. In both cases the existing processes were not making full use of their potential.

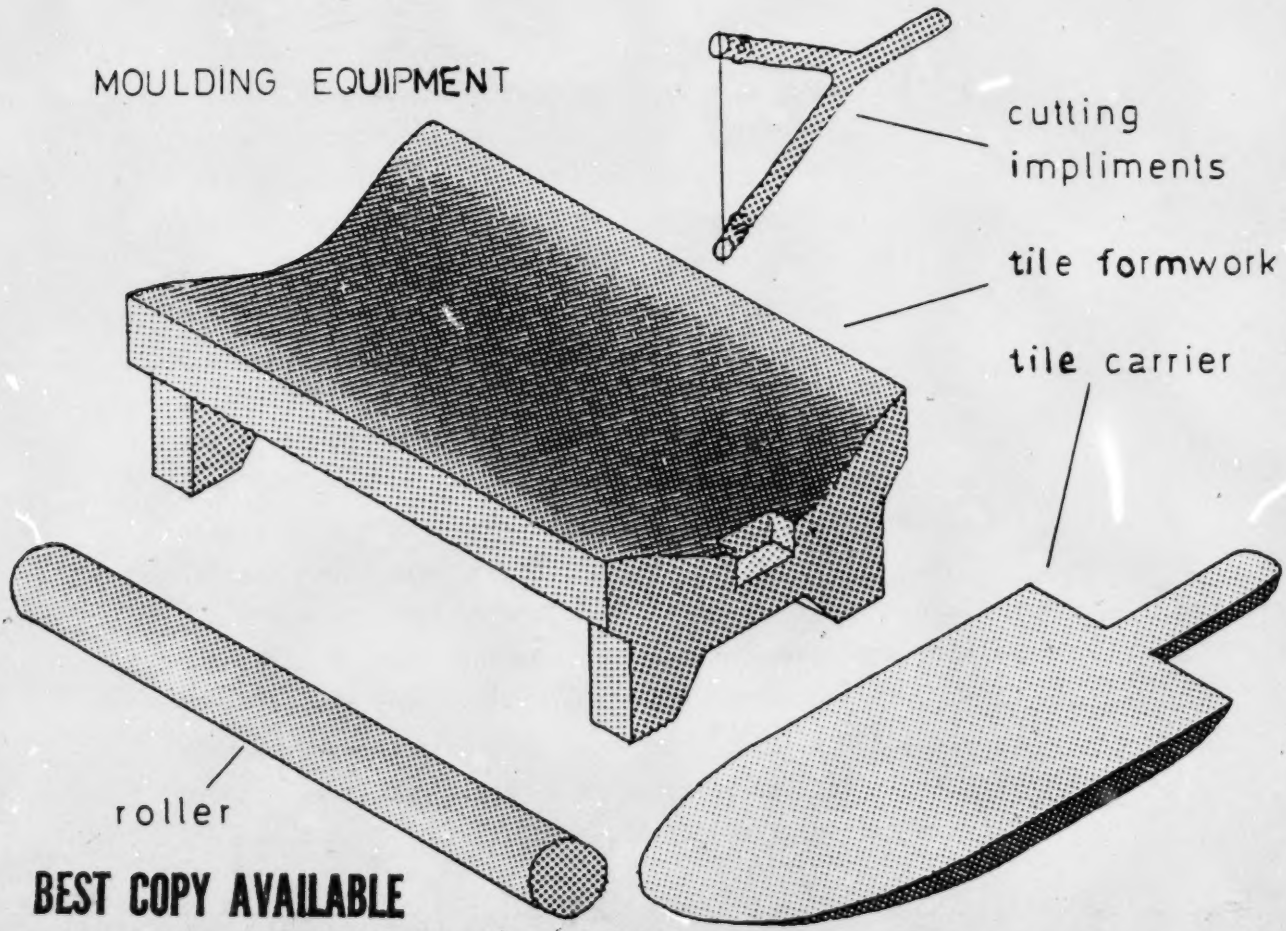
B.3 'Pan' Tile production. Chubhar, Gilan (Astara Area).
The tile kilns in the Astara area produce a 'Pan' type tile, measuring 31 x 20 cms, with a shallow 'S' shaped profile. (Fig. B.2) They provide a good coverage on

Fig B2 PAN TILE - 15 -



Astara-Lisar
Pan Tile
Specification
measurements in
centemeters

MOULDING EQUIPMENT



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the roof with a minimum amount of overlap between tiles. Because this is a single lap tile, its weight is relatively less than the double lap tiles used in the Neka/Behshar area, and the roof structure required to hold it up is less.

The existing process of making tiles in the Astara area is highly labour intensive process. The kiln described in this case study at Chubhar, employed 5 people. One man ran a horse driven clay mixing mill, where clay, after soaking in water, is mixed until it has the right consistency for moulding into tiles. Clay comes from nearby. (Fig. B.3) This mixed clay is delivered to the moulding and drying sheds. These sheds are low covered structures which provide shelter from direct sunshine and rain, but which allow air movement through the shed which is important in the drying process of the formed tiles. In the centre of the drying shed is a space set aside for the moulding of the tiles. An assistant takes the clay which has been brought from the mill and forms it into lumps, each lump sufficient for one tile, and then rolls it flat. The tilemaker cleans his shallow wooden mould and sprinkles sand over it to prevent sticking. The clay is pressed into the mould with a wooden roller, and extra clay is trimmed off round the edges. The mould and clay are turned over onto a suitably shaped platter, which the assistant uses to carry the tile to the drying racks. The drying sheds surveyed could hold more than 9,000 tiles. Drying takes 2 to 3 weeks. When the tiles have dried to about 10% moisture content and are rigid they are ready for firing. Loading the kiln takes one day, firing another four, and a final day for unloading. About 700 tiles are produced by a team each day. About 7,500 tiles can be fired in a week, In this kiln there were two teams of men moulding tiles.

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Fig B3 MECHANICAL ANALYSIS OF SOIL

LOCATION: Chub-bar , Gilan, Iran

SITE: tile-kiln

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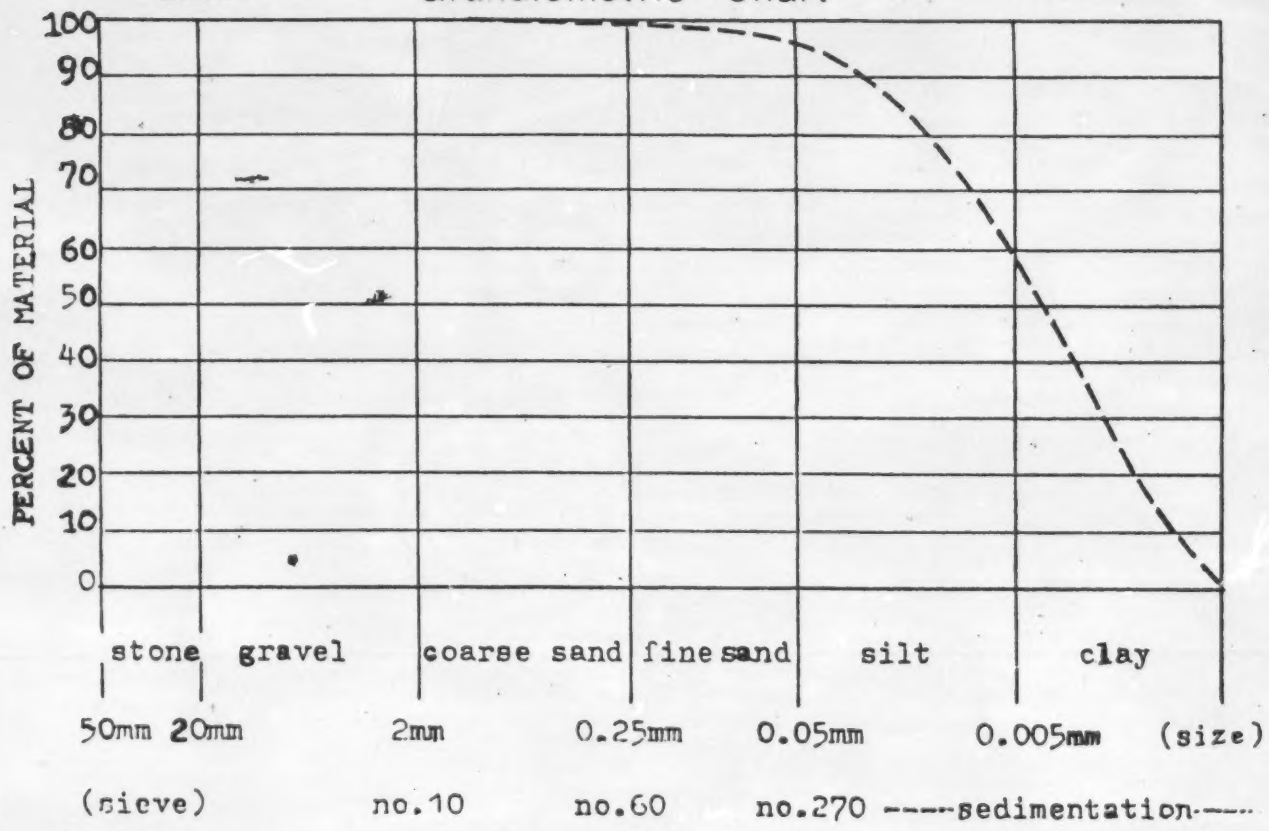
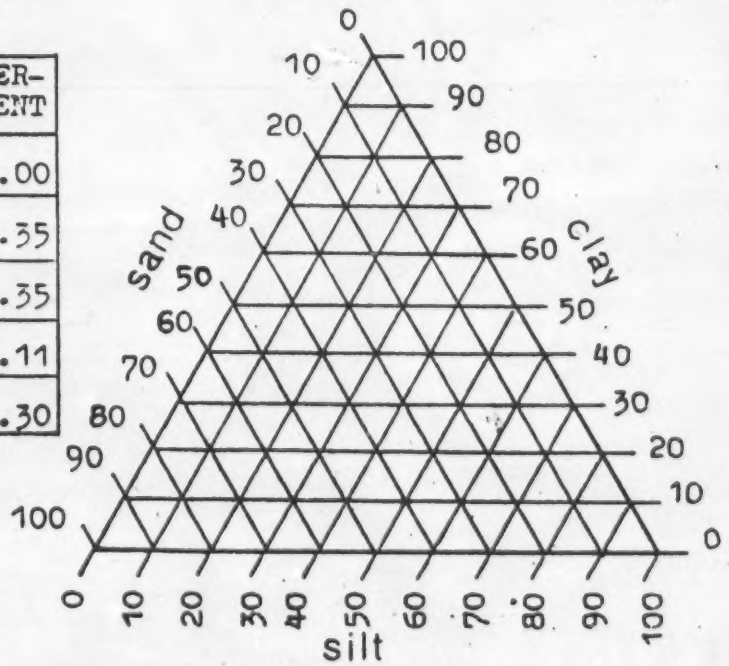
Granulometric Chart



Particle Gradation

PARTICLE	mm SIZE	no. SIEVE	PER-CENT
Gravel	+2	10	0.00
Coarse Sand	+.25	60	0.35
Fine Sand	+.05	270	14.35
Silt	-.05	270	59.11
Clay	.005	sed.	26.30



Classification Chart

Soil Classification:

Clay-Silt

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Tile moulding is contracted at a rate of 4,000 Rials (Iran) (approx. US$ 60 at 1978 rate) per thousand to the master who is responsible for the skilled work of actually moulding the tile. He in turn pays a daily salary of 500 Rials (approx. US$ 7 in 1978) to the worker operating the clay mill and 600 Rials (US$ 8.5 in 1978) to his moulding assistant.

The kiln is fired with wood and costs about 5,000 Rials per firing (US$ 70 in 1978). (Fig. B.4) At the time of the survey tiles were marketed at a cost of 9,000 Rials (US$ 130 in 1978) per 1,000 tiles. Rapidly increasing labour costs have raised tile prices in the previous 3 years from 3,000 Rials per 1,000 (US$ 40) but the tile is still competitive with other roofing materials and is favoured in the area.

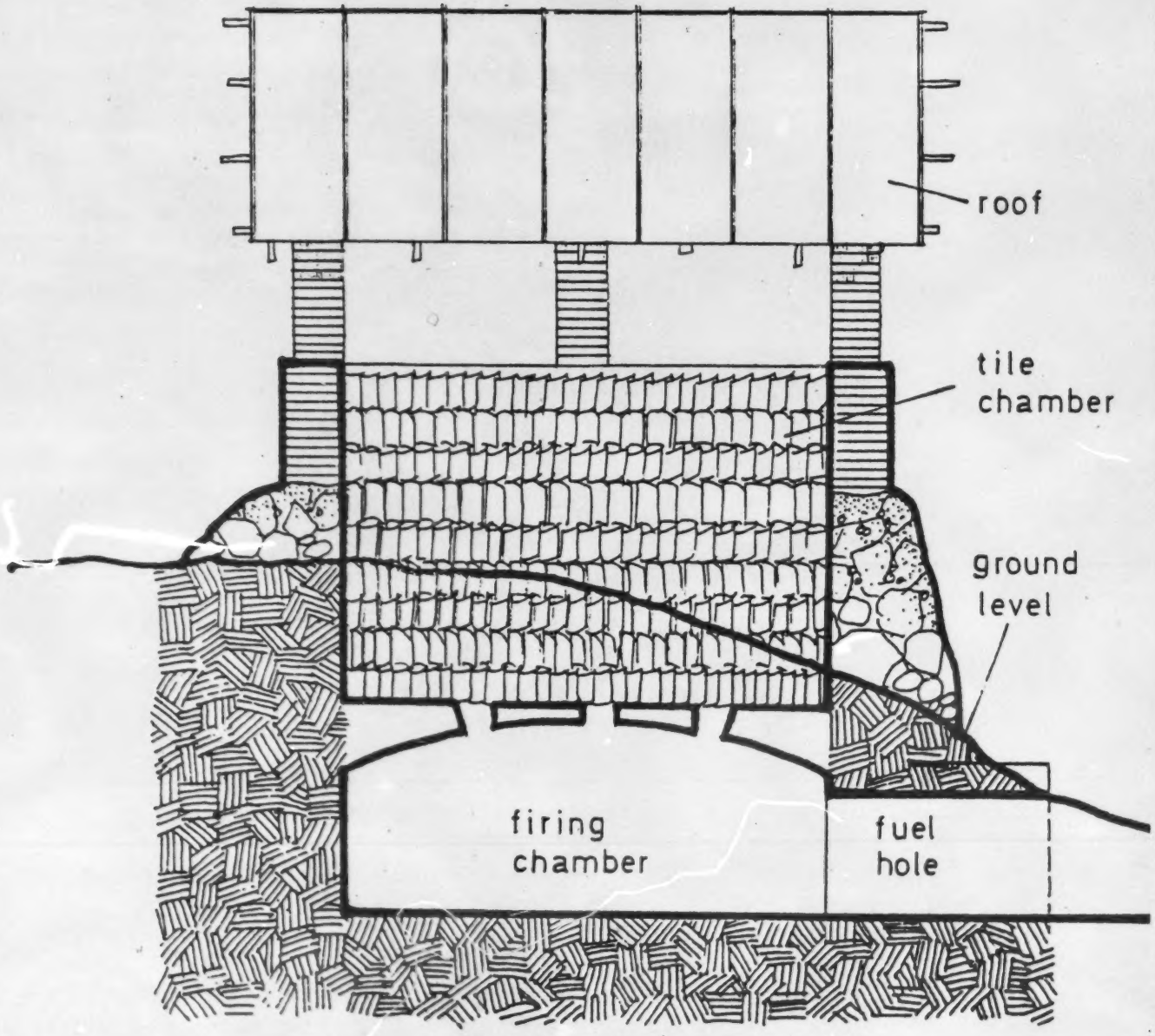
Tiles are only produced over a 6 month period (Summer). In winter the atmosphere is too damp and tiles will not dry enough to be ready for firing.

B.4 Improvements

It was possible to propose various improvements to the production in the area. However, it was essential that, whilst efficiency needed to be improved if the tiles were to remain competitively priced, any alteration to the present system had to be at minimum cost and without removing employment generating component in the industry. The kilns in the area were all labour intensive and labour was a significant item in the running costs of the kilns.

The capital costs involved in introducing mechanisation into the process were regarded to be too high for the small production yards in the Caspian, although mechanical moulding and mixing would have greatly increased the output.

Fig B4 Tile Kiln - section
Chubhar , Gilan



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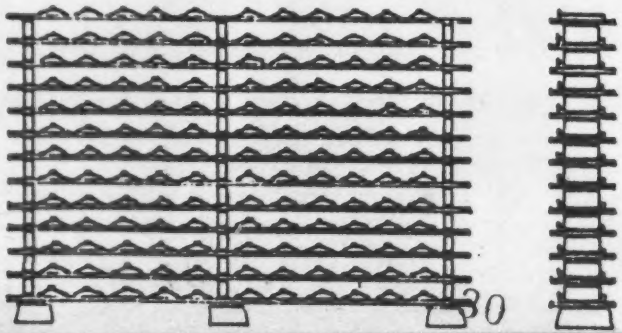
Tile Drying Racks



There would also be a degree of centralisation into larger production units, which would in the long run cease to be an important source of rural employment.

Rationalization of the tile making process was regarded as being the best approach, without destroying the employment generating potential.

It can be seen from the plan of the Chubhar kiln (Fig. B.5) that the positioning of elements; work areas, drying racks, and kiln; are in a random fashion. A great deal of time and labour is spent transporting clay to the work area, and the tile to the drying racks and then to the kiln. Additionally, because the firing process requires several days for unloading and cooling, tiles cannot be fired continuously. Also, because of the intermittant nature of the firing process, requiring periodic labour inputs, there is little specialisation of the production activities. (Fig B.6) It was proposed that the production method could be rationalized by improved site organisation and better management of labour.

Fig. B.7 shows the proposed layout for an upgraded tile production site in the Chubhar area. Two kilns, fired alternatively, are used, so that tiles are being constantly burned. Elements such as the clay mill and drying racks are positioned so as to cut down transportation distances. The same production method as already exists in retained, being directly related to employment. However, a high degree of specialization means that the tile-moulder or his assistant need not leave their work periodically to help load or unload the kiln. A new specialised role of kiln keeper is created; he has the skilled task of supervising the laying of the kiln and maintaining the firing temperatures. He has an assistant

Fig B5
Tile Production Unit
Chubhar , Gilan

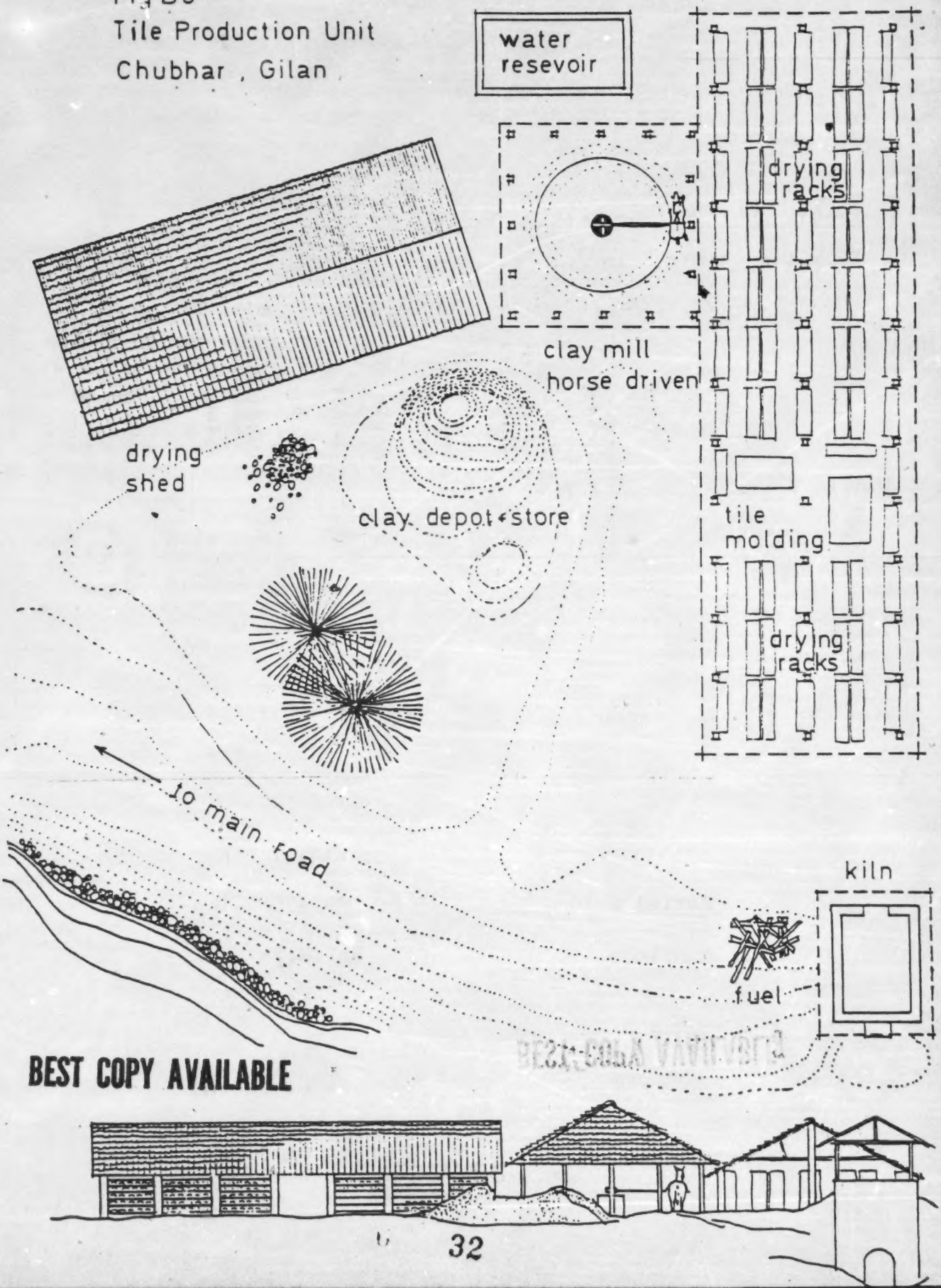


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Fig B 6

Traditional Tile Production System

From the Chubar Kiln

(Output 7,500 tiles per week)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Wage in Rls.
Kiln Schedule	l	f	.....	.....	➤	c	u	l	f	.....	.....	➤	c	u	
Tile Maker 1	l	f	Moulding				m	l	f	Moulding				m	1500
Assistant 1	l	f	Stacking				u	l	f	Stacking				u	600
Tile Maker 2	Moulding ..... ➤						..... ➤							.....	1500
Assistant 2	Measuring and Stacking ..... ➤													.....	600
Mill Worker	Milling ..... ➤						u	Milling ..... ➤						u	500
													Total Labour Cost		4700

l	Loading Kiln	u	Unloading Kiln
f	Firing Kiln	m	Moulding Tile
c	Cooling	▨	Holiday

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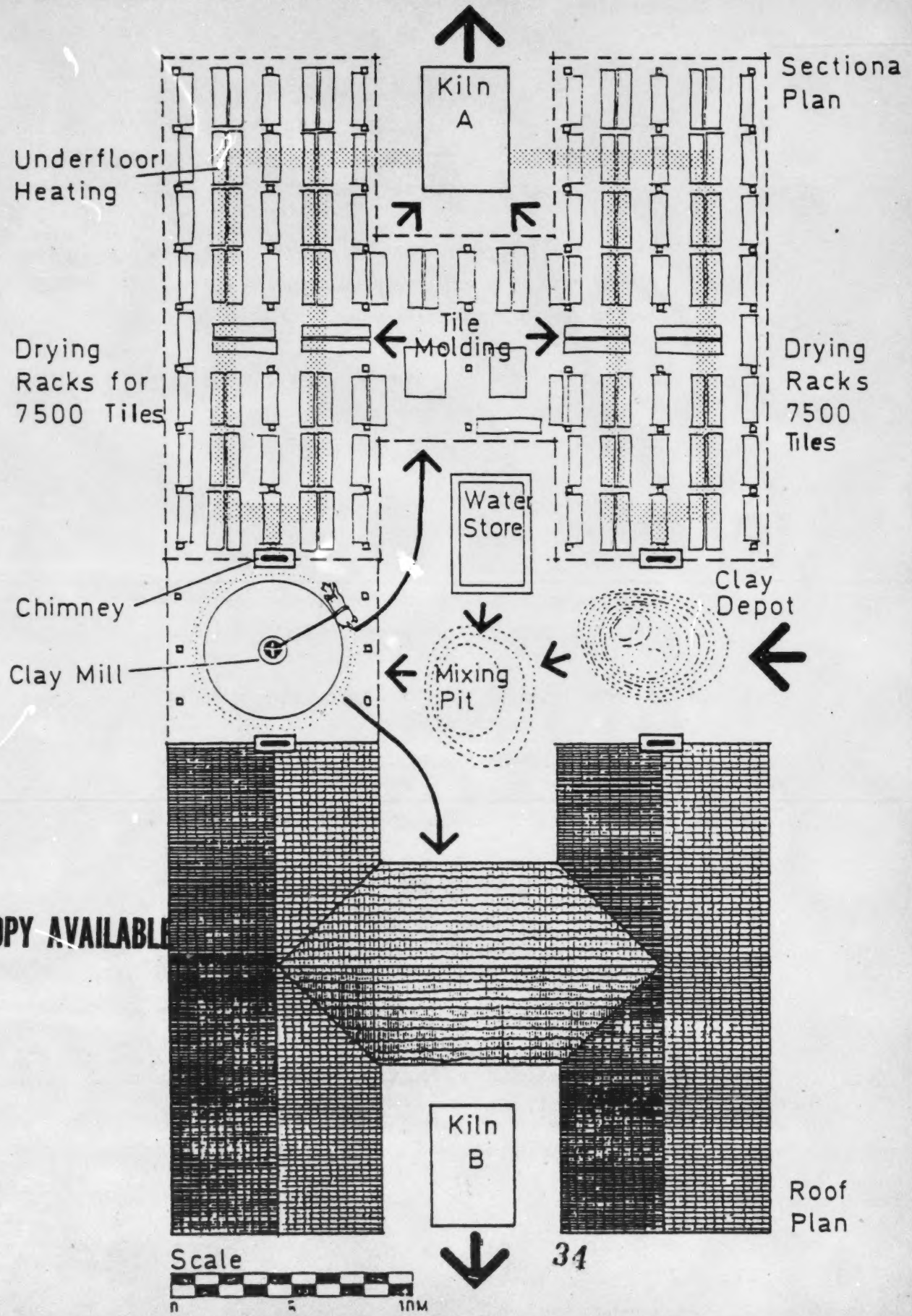
Fig B 7 IMPROVED PRODUCTION SYSTEM



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who also helps work on the mill on the days that there is no work in the kiln. (Fig. 8.8) With the present firing and production methods, this alteration results in an increased efficiency of about 27%.

It was also suggested that the exhaust heat from the kilns could be used for pre heating and drying tiles before being put in the kiln. About 30 - 40% of the heat generated in the kiln and the kiln structure is lost to the atmosphere in cooling after the firing period. By channelling this exhaust and waste heat under the drying area, the drying process could be improved.

The major effect of this would be to increase the period of tile production from the present 6 months to nearer twelve, hence doubling production. It still remains to be seen whether the market demand in the area will justify this extra production.

Alternative fuels to timber are also available, but oil, to which the kilns can be easily converted, is rising in price in Iran as elsewhere, even though its use is subsidised. An immediate improvement to the present system was suggested: Normally, the timber used in the kiln is left out in the open before use, and still has a high moisture content, of 25% or more, being freshly cut. It was suggested that a covered storage area should be introduced, which would allow the timber to dry. Air dried oak, has a moisture content of 12-15%, as opposed to the 25% content in timber used now. Drier wood produces more heat per cubic metre, with corresponding reductions in the quantity of wood being burnt.

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Improved Tile Production Unit

Fig B 8

Labour Organization and Kiln Firing Schedule

(Cutput 15,000 tiles per week)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Daily wage in rials
Kiln A	I	f	.....	.....	.....	c	u	I	f	.....	.....	.....	c	u	
Kiln B	.....	c	u	I	f	.....	.....	.....	c	u	I	f	.....	.....	
Kiln Keeper	A	A	B	B	B		A	A	A	B	B	B		A	1000
Kiln Worker	A	M	B	B	M		A	A	M	B	B	M		A	500
Mill Worker	Operate Clay Mill													.....	500
Tile Maker 1	Moulding Tile for Kiln A													.....	1500
Assistant 1	Measuring Clay and Stacking													.....	600
Tile Maker 2	Moulding Tile for Kiln B													.....	1500
Assistant 2	Measuring Clay and Stacking													.....	600
Apprentice	Moulding Tile Alternately for Kiln A&B														800
													Total Labour Cost		7000

I Loading Kiln

f Firing Kiln

c Cooling

u Unloading Kiln

A Kiln A

B Kiln B

M Mixing

Holiday

B.5 Conclusions

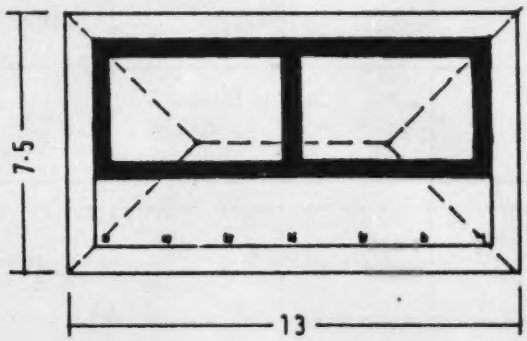
In this case, the improvements were all within the capability of the existing skills and resources. Nothing new was required from outside the area. Improvements are necessary if industries which are viable now are to remain so in the future, as they face increasing competition from new materials and techniques brought from elsewhere. Another kiln, in the Neka-Behshahr area (Mazandaran) had ceased to function because, whilst there was still a demand for tiles, they could no longer be produced at efficient costs. A more substantial reappraisal of the production method and tile form was required. Changes to the tile form in the Neka/Behshahr area (Spanish tiles) would, however, require major alterations to structures, since a tile which produced a more efficient coverage for the material used (i.e. a 'Pan' tile as used in the Astara area) would need a different arrangement of battens on the roof. The acceptability of such a change needed to be established before implementation of changes to production could take place.

APPENDIX 1

Notes on 'Roofing Materials Comparative Costs Chart'

*1 The price of one labourer's work in one day (which at the time of the research was 600 Rls.) is taken as the basic unit of cost, and all costing figures given in the table are fractions and multiples of this unit. Since the prices of local materials in the Caspian area include a large labour component in production, this appears to be an appropriate unit. The labour unit maintains its comparative value over time as prices change.

*2 The unit of construction is taken to be a standard two room house with a front 'aivan' covering a built area of 97.4m. The pitch of the roof varies according to the different roof covering material used and thus the surface area of the roof to be covered also varies.



On comparing Costs:

The costs should be regarded in connection with the lifespan of the material, although in rebuilding the roof after its period of lifespan some materials may be salvaged in certain cases and the cost of the new roof is not necessarily as high as the original roof. Also it should be noted that low income groups find it economically easier to invest a small capital in a relatively short term structure than a large sum in a longer lasting building. Thus a relatively small initial capital outlay with periodic inputs for maintenance is more geared to a rural family's economy.

ROOFING MATERIALS: COMPARATIVE COSTS

name of material	Rice Thatch	Reed Thatch	Shingles	Rasht Tiles	Astara Tiles	Sheet Metal
local name	Koloush	Lee	Lat/ Takhteh	Sofal	Sofal	Halab
cost*1 of material/m^2 Roof Surface Area	0.075	0.155	0.333	0.378	0.450	0.413
cost*1 of construction/m^2 Roof Surface Area	0.133	0.133	0.050	0.165	0.050	0.166
total cost*1/ m^2 Roof Surface Area	0.208	0.288	0.383	0.543	0.500	0.579
pitch of roof°	55°	55°	25°	25°	35°	25°
surface area of roof m^2	170	170	110	110	120	110
cost*1 of material/unit of construction	12.5	26.	37.5	41.	54.	45.5
construction cost of unit*2	22.5	22.5	5.5	16.5	6.	18.5
total cost of unit *2	35.	48.5	43.	57.5	60.	64.
lifespan yrs.	8-12	15	15-20	25-30	25	20-25
maintenance requirements	thatch renewed in parts of roof. Ridge rope tightened & replaced when rotted.	ridge rope tightened every yr. & renewed when rotted.	shingles turned over every 5 years.	lower tiles moved to the surface after 15	-	joints loosened by wind are tightened. Rusted holes are fixed

PUBLIC BUILDING, SELELEH. WESTERN IRAN.

Contents

1.	Introduction	Page 30
2.	School building	34
3.	School Building	
	3.1 Kaka Reza	36
	3.2 Ab Barik	36
	3.3 Kindergarten, Alashtar	41
4.	Village centres	44
5.	Water supply and Public Bath building in Serab Seid Ali	

Illustrations

Fig. 1	Location of Selseleh in Iran	
2	The Selseleh Basin	31
3	Primary school at Kaka Reza	37
4	Location of new school at Ab Barik	40
5	Schematic section, Ab Barik School	40
6	Kindergarten plan, Alashtar	42
7	Village centre with accommodation	45
8	Village centre with agricultural store	47
9	Location of new facilities in Serab Seid Ali	49
10	Two shower public bath, Serab Seid Ali	52

PUBLIC BUILDING

Building of Schools and other Public Building in Selseleh, Western Iran.

1 Introduction

The practical conclusion to the research, training and small scale industry programmes, is the channelling of the resulting increased understanding, expertise and material resources into the physical process of meeting the building needs of village communities and small town neighbourhoods. This is also an extension of the training programme, both in terms of passing on the skills that the builders have acquired to those members of the community who will participate in the building process, and in becoming involved in the decision making process of what sort of facility or building is required by the community.

The overall process of public building is in this context educational as well as practical. The examples given in this paper were all done as part of the work of the Selseleh Integrated Development Project (S.I.D.P.), Luristan Iran. (Fig. 1)

In the Selseleh project area there was a shortage of almost every type of facility: schools, public baths, clinics, water supply, roads etc. Establishing these facilities in the region formed an essential part of the practical work of the S.I.D.P. However, to ensure their future success and proper functioning, such facilities cannot be introduced into a community without the participation of the people who will use them. This participation must be at all stages of a proposed building programme, but most of all at the decision making stage. They are the people who know best what is needed in their community, and in several cases we found that

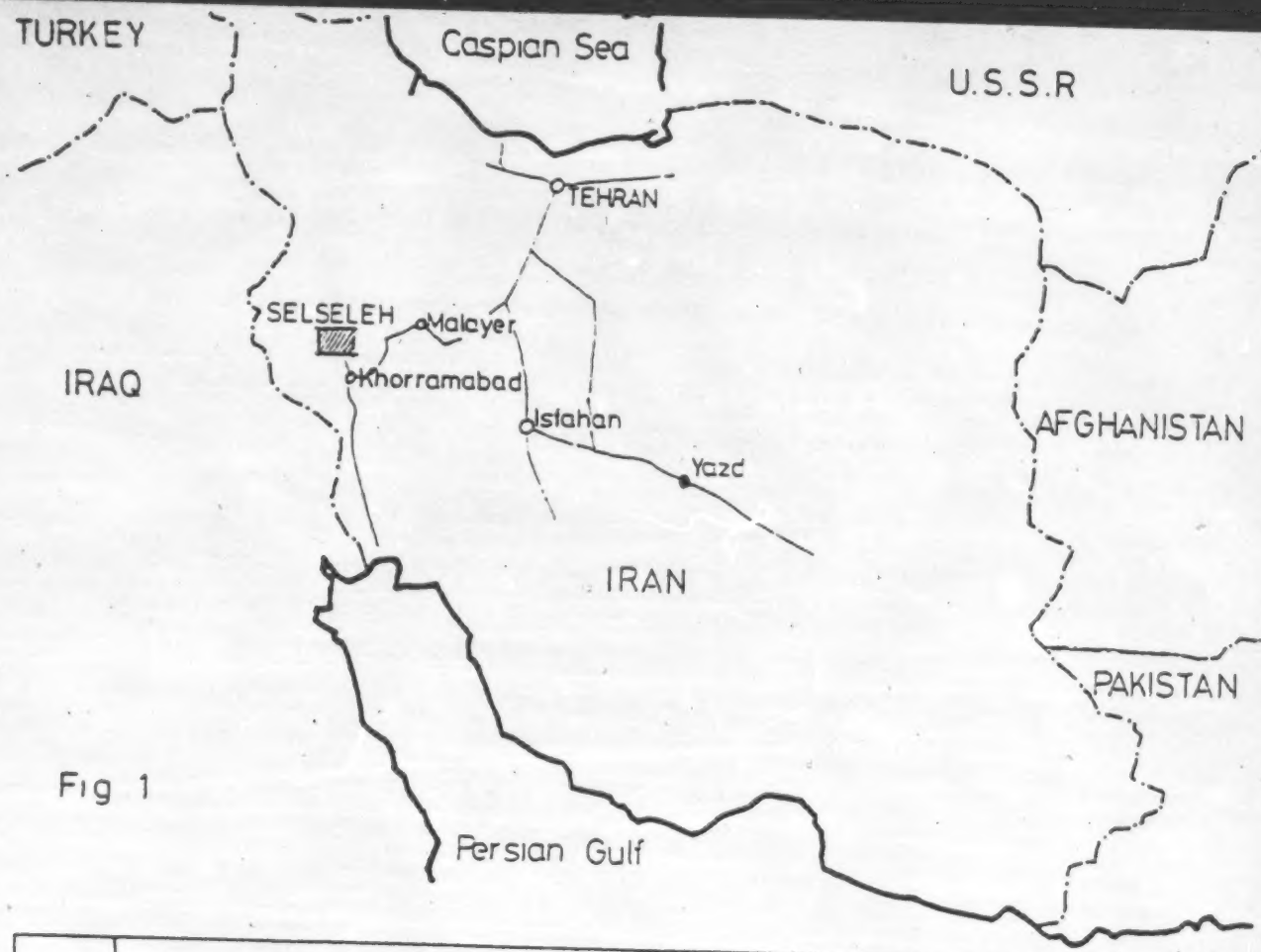


Fig 1

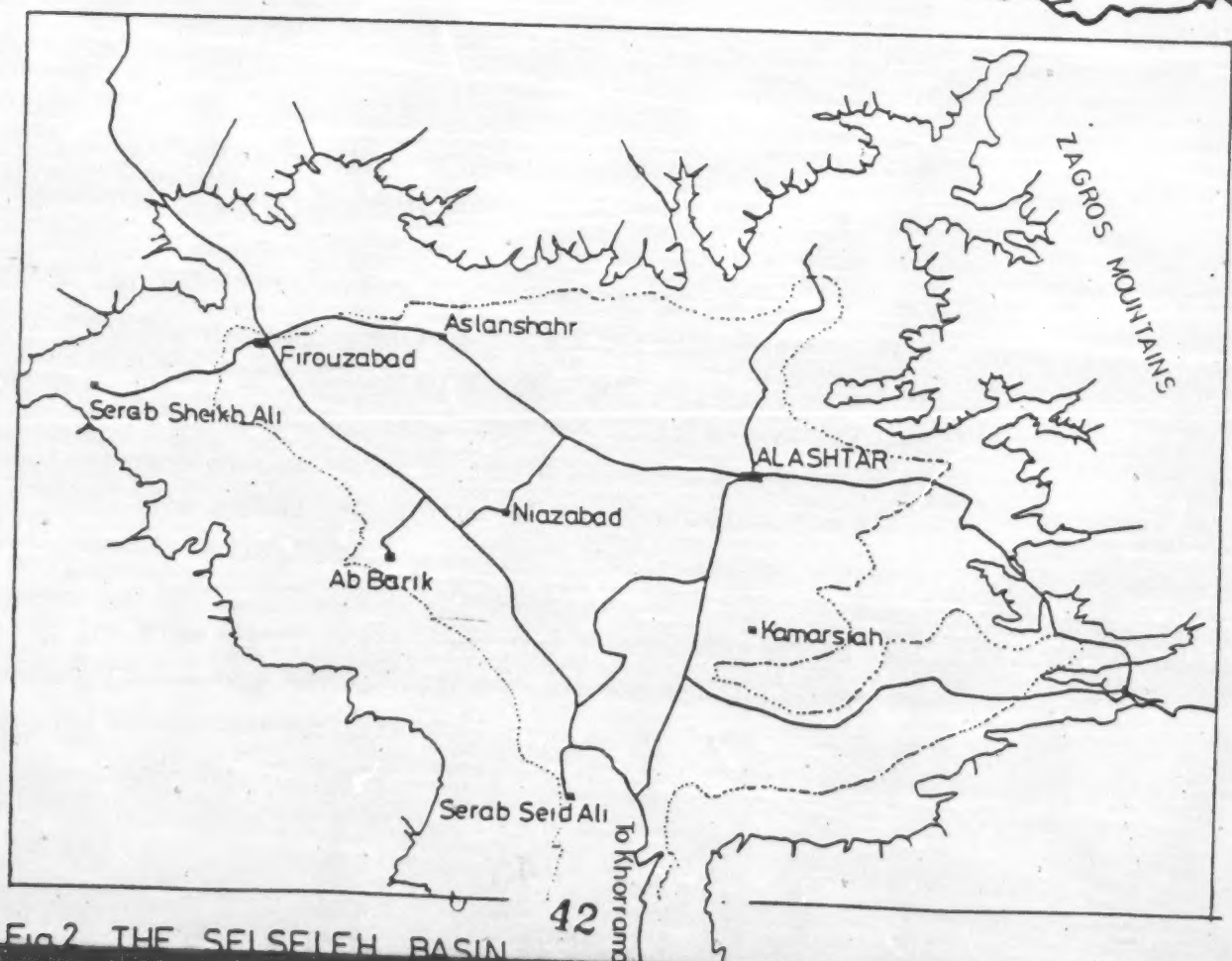


Fig 2 THE SELSELEH BASIN

the required facility was different from what we had expected. At the same time, people recognised that there were certain buildings which were more difficult for the village to complete than others. (i.e. in building a public bath, the mechanical servicing is often beyond a village's current capabilities.)

In the village of Niazabad, (Fig. 2) the S.I.D.P. organised and built a public bath at the request of, and with the active participation of, the villagers. The building was too complex for them to complete on their own, and would have placed a large burden on the village resources. In the two years that followed the completion of this bath the village independently built a school and were then starting on a Mosque. The process of building the bath had helped to reinstate their confidence to undertake such schemes and to counter their belief that the Government would and could provide such facilities to every village.

Much of the communication between the village communities and the S.I.D.P. took place through the 90 trained 'Front line workers', who, as members of both, could reflect the needs of the village and the role that the S.I.D.P. could play. Through this process, these same people learnt how to approach the Government for assistance and to know what was available, and, through their activities in the village, gained the trust of the villagers as people who could and would actively help in resolving village problems and needs.

Some of the difficulties that the villages faced could be resolved by providing information; on the one hand about what they could reasonably expect from the Government (and the S.I.D.P.); and at the same time, how they

could organise themselves to make better use of these and their own resources..

For example, the Government of Iran at that time (1976/7) would provide up to 50% matching funds to supplement money collected by a community for a specific project. Many people were unaware of this or how to go about acquiring these funds. On the other hand, some form of organisation was needed if the funds were to be used to the best advantage of the village. The use of government funds had normally dictated that the required building was designed in centralised offices and that the building was erected by a recognised contractor (usually city based). In almost all cases this resulted in costs being high and the building itself not being suited to the specific needs and location of the village. The villagers did not participate in the process nor were any local resources used. Furthermore, the villagers invariably regarded the finished product as being the responsibility of the Government and were rarely prepared to participate in its upkeep and running. In instances where the building ceased to function properly, often through lack of maintenance, it sometimes stood idle for years, even though the skill and equipment was often available in the area for repairs. To resolve this situation further stretched the capability of the Government, which, faced with national shortages of public facilities, were even less capable of providing them.

The understanding that the people of the region gained about their role in developing the area had to be supported by the training programmes: builders; health, education and agriculture workers; producing teams who would be able to help the villagers practically meet their needs: and by the stimulation and development of the uses of local resources.

The case studies for the Builders Training Programme *1 and the stimulation of small scale building industries formed only a part of the overall process. Through this process, the incentive to develop the region could be matched by an increasing capability to do so.

2 School building

The few schools that existed in the region prior to the setting up of the S.I.D.P. were either in extremely poor repair (usually the Government built schools) or based in small dark rooms. It is worth noting that many of the problems in the schools derived as much from the school furniture as from the buildings themselves. The standard form of school seating and desks were in bench form, with each child leaning back against the desk behind. This produced an extremely cramped seating arrangement, since one could not space the desks and benches further apart. Efforts were made to alleviate this situation and introduce more suitable and flexible furniture.

The arrangement of classrooms and the elements within them were also poor. Common conditions included: small windows, sometimes reduced in size during the winter to keep the heat in. The level of lighting was invariably low, making it hard for the children to see what they were doing. In the villages there was no electricity. The ventilation of these classrooms was often very poor. Windows were positioned so that light was often directed disadvantageously at the children, so that they were writing in the shadow of their own hands or could not see the blackboard because of direct sunlight shining into their eyes. The orientation of classrooms often meant that sun and heat came into the classroom during the hotter periods of the year, whilst not allowing either in winter, (i.e. classrooms facing east

*1 Reference title: NORTON. J. Builders Workshop. Yazd, Central Iran. Case study for UNESCO, 1980, Unpublished.

and west).

Sanitary arrangements were poor (sometimes almost non-existant). There was no provision for recreation during periods of the year when rain and snow restricted out-door play.

School building in the area depended largely upon the likelihood of getting a teacher to live in a rural community. This difficulty tended to focus schools upon the larger communities where transport and facilities were better. This was not an ideal arrangement since the children were then forced to walk considerable distances to school. Across the Selseleh plain there are numerous rivers and streams, which in many cases meant that the distance to be walked was increased by not being able to cross to a nearby school.

A major aspect of the S.I.D.P. programme was to establish a comprehensive network of roads connecting the villages to each other and to the regional centre, Alashtar. This network allowed the regional planning of facilities to develop upon groups of villages, who could share common facilities within easy reach. It would have been both physically impossible and impractical to attempt to provide facilities in every settlement. Moreover, many of the settlements were little more than extended family groupings, and sometimes numbered only a few houses.

The shortage of teachers was alleviated by the training programmes run by the S.I.D.P., which produced people in the villages capable of teaching at primary school level and of running adult literacy classes.

To meet the demand for schools and other public buildings, within the limitations of the funds and resources available, it was essential that local resources, skills and manpower was used.

3 School Building

3.1 Kaka-Reza

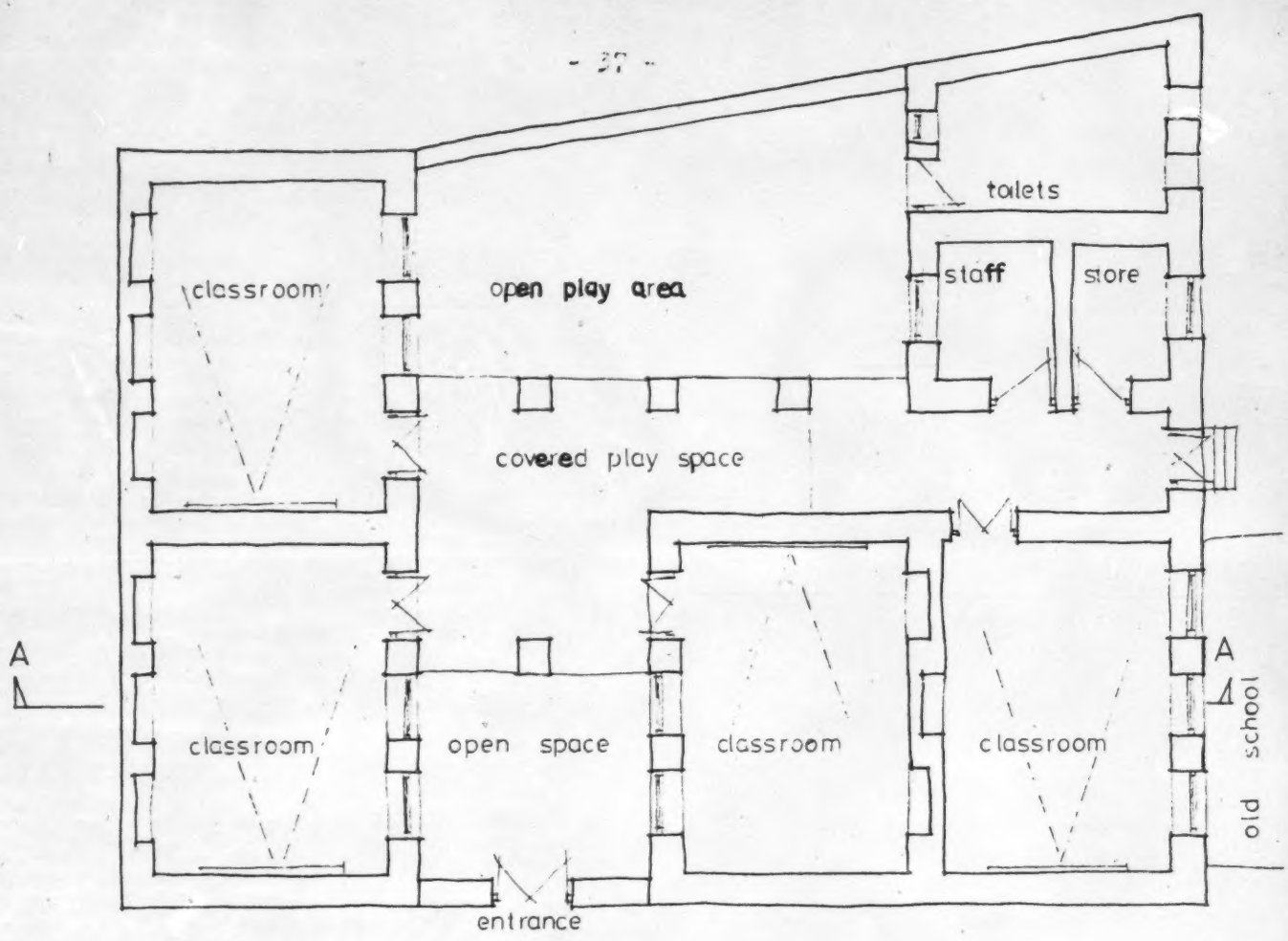
The school building in Kaka Reza (Fig. 2) illustrates some of the possibilities that occur when the people in the community are involved in the process and local resources are used.

The villagers of Kaka Reza asked the S.I.D.P. to assist them in building a new school. The village had already organised funds for the building, with some of the money coming from the Ministry of Education. (It was in fact unusual to find villages that had organised this.) The costing of the building had been to allow enough to replace two existing classrooms with two new ones. This allowed nothing for the growth of the village, nor the provision of additional facilities; storage, sheltered play space etc. The school was therefore redesigned so that there would be four classrooms, a teacher's office, a store room, lavatories and covered and open play areas for summer and winter use. (Fig 3) The additional space at the original cost was made possible by using local stone for the walls and timber for the roofs instead of concrete and steel as had originally been intended, and by using local labour and builders from the region. Some families who had not been able to donate money were in this way also able to contribute valuably to the scheme.

3.2 Ab Barik

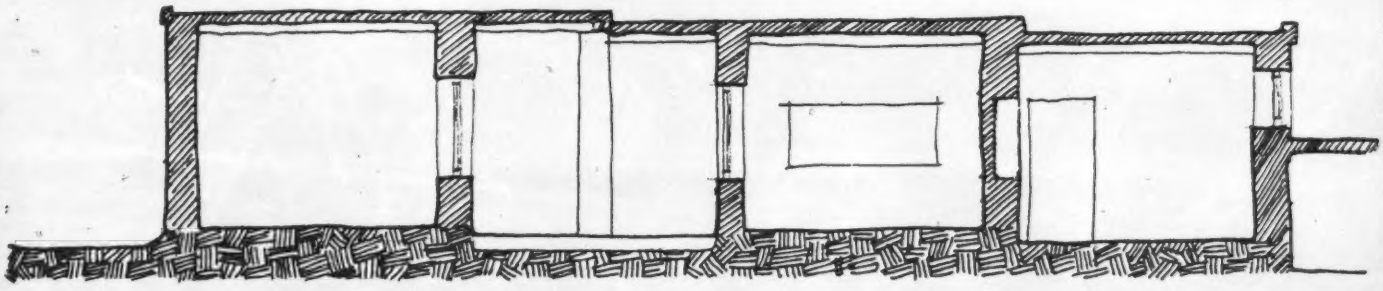
The building of a new school in Ab Barik (Fig. 2) was also started to replace an existing school, but in this case the village was not seriously involved at the beginning. A number of problems developed.

The village had an existing small primary school in its centre. It was overcrowded and poorly lit. In winter



PLAN

Fig 3 PRIMARY SCHOOL AT KAKA REZA



SECTION A-A

metres

0 1 2 3 4 5

the one classroom was heated by a large oil fired heater placed in the middle of the room which obscured the view between teacher and pupils. The fumes given off by this heater were noticeable even during a short visit to the classroom. The windows were sealed up to keep the heat in.

As part of a national programme, a group of students came to the area for their summer vacation, with the task of involving themselves in local activities. These students, mostly from Tehran, undertook to build a new school in the village of Ab Barik. They requested that land should be donated for this scheme. The village itself is situated on a small hill. The land donated was down on the flat land below the village. A start was made on the building, and then the students returned to their colleges. The building work came to a standstill, and the people from the village came to the S.I.D.P. and requested that the S.I.D.P. should finish what had been started.

During the first visit to the site, a number of problems were noted, and because parts of the building were relatively advanced, some problems were beyond rectification.

The land that had been donated was unusable for any other purpose, and explained why it had been given. This in itself reflected the attitude that the village had had to the building when it was started; they were not involved in the building and therefore had little desire to give valuable land. The building had been positioned almost directly in the route of a flood path.(Fig. 4) The whole area showed signs of regular flooding during the rainy season. The orientation of the building and its windows was towards the east, which was unfavourable because of the build up of heat during the morning in the summer,

whilst not permitting low winter sunshine to penetrate and warm the rooms in winter, when the sun is further south in the sky.

The villagers themselves orientated their buildings to face south whenever possible, to assist in keeping them cool in summer and warm in winter. Equally, they would not have built on a piece of land which they knew was liable to flood.

To rectify the situation, a channel was dug to ensure that any flash flooding water would pass safely beyond the site. It was possible, because some of the building work already done was of poor quality, to move the orientation of the building round to the south, whilst retaining part of the walls already built. A pit at the rear of the building was filled in, since otherwise it would have weakened the foundations.

The villagers were encouraged to participate in the building work, whilst the S.I.D.P. provided two trained builders.

The new school was developed upon the same principles that applied to local houses. A covered area at the front of the building provided shade in summer, helping to keep the classrooms cool but allowed sun to shine in underneath the projecting roof into the classrooms in winter. (Fig. 5) This same space was used for recreation in winter. The classrooms were organised so that the occupants would sit with light coming from the left hand side. A chimney for the heater was built into the wall of each room; in the old school the chimney was a metal pipe free standing in the room, dictating the poor position of the heater. In addition to the main

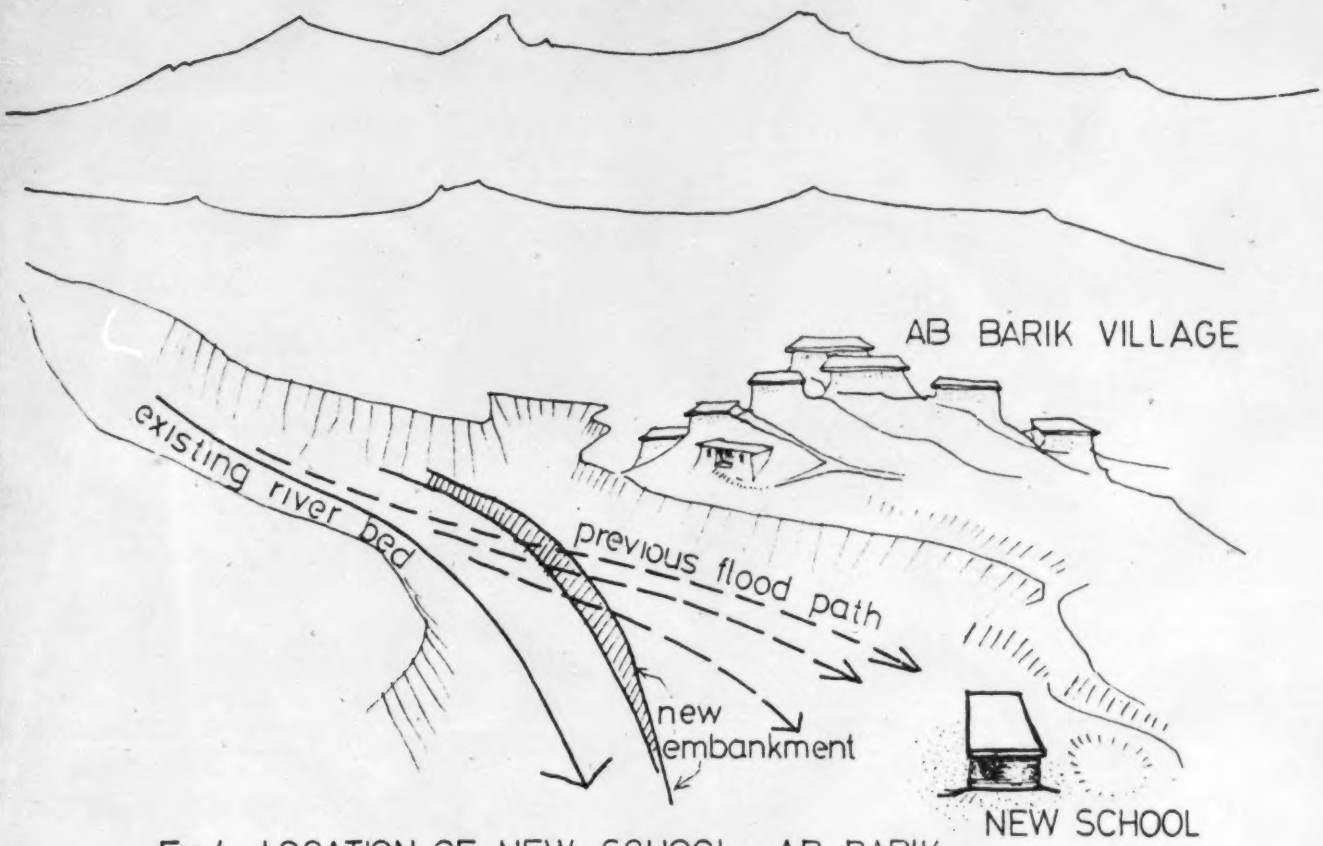


Fig4 LOCATION OF NEW SCHOOL - AB BARIK
All existing building safe on high ground

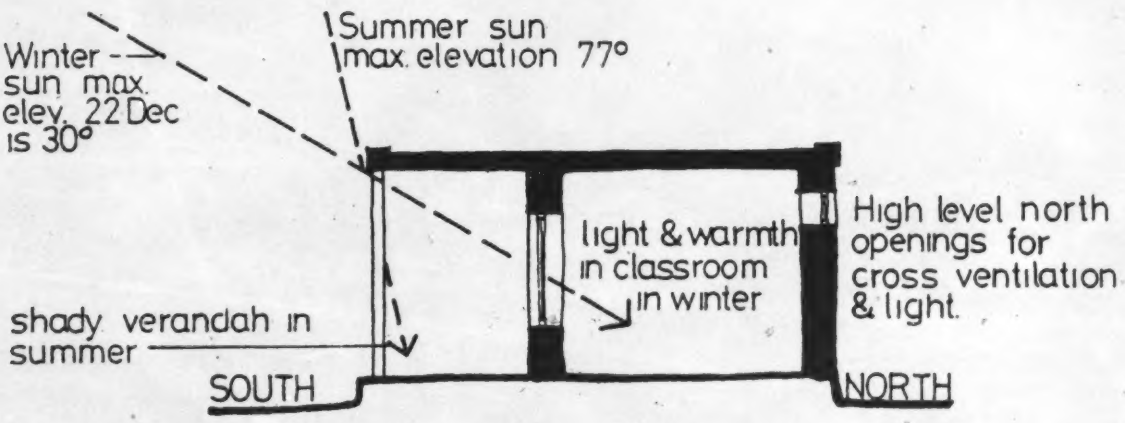
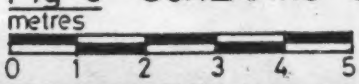

Winter sun max. eley. 22 Dec is 30°
Summer sun max. elevation 77°
light & warmth in classroom in winter
High level north openings for cross ventilation & light.
shady verandah in summer
SOUTH
NORTH

Fig 5 SCHEMATIC SECTION - AB BARIK SCHOOL



south facing windows, small high level windows were included on the north facing wall to permit cross ventilation and provide additional light. (Fig. 5)

The finished school was simple, but some of the original problems had been overcome. They could have been easily avoided in the first place if consideration had been paid to the local conditions and to the existing knowledge and dwellings in the village.

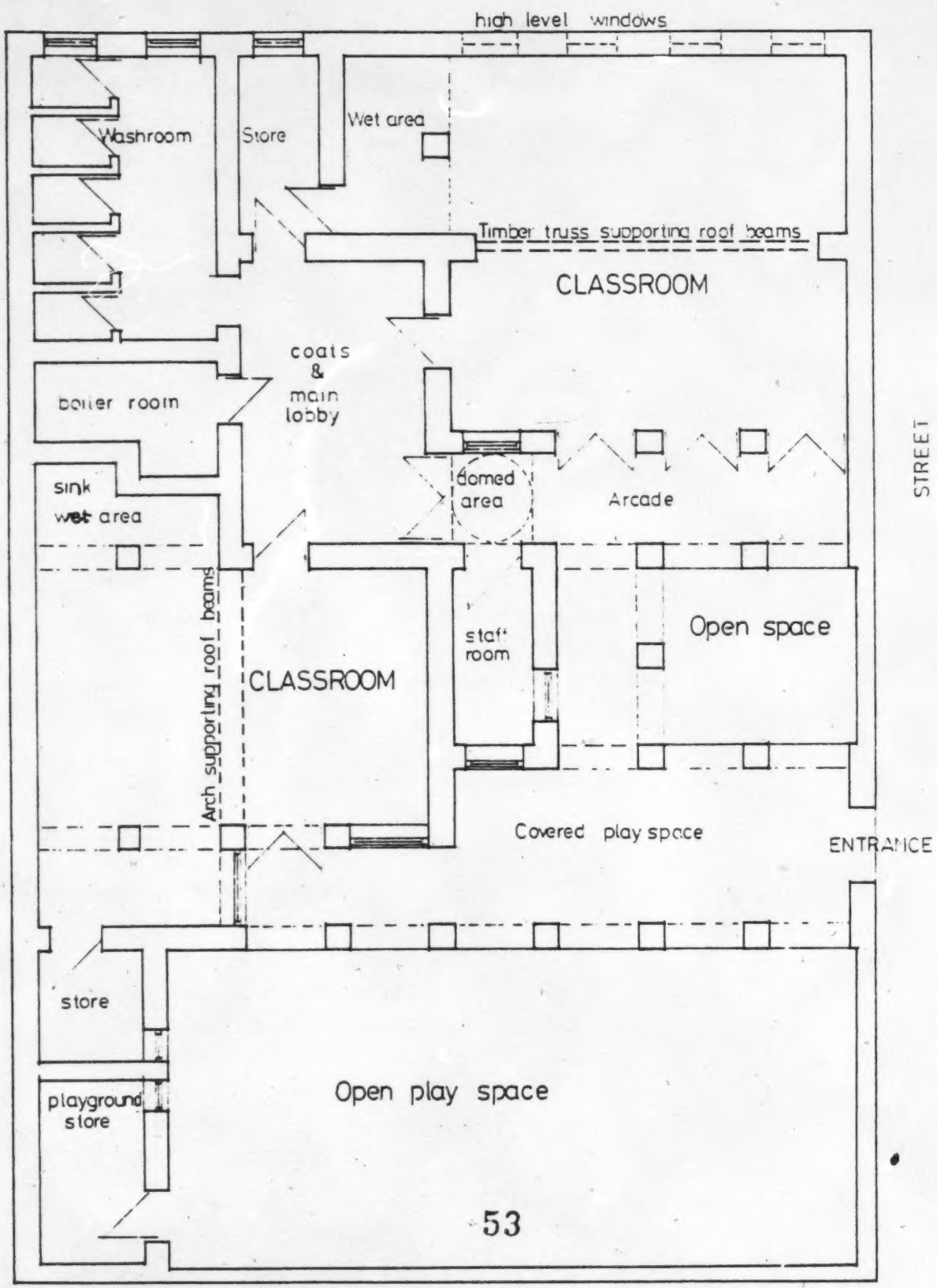
3.3 Kindergarten. Alashtar

In all the schools built by the S.I.D.P. the process of building was used whenever possible for training. In addition to this, most of the public building work was designed so that they would have a relevance to the housing problems faced in the area, and that people in the area could use techniques and ideas introduced through the public buildings to improve their housing.

The Kindergarten in Alashtar (Fig. 2) was an example of this approach. It was felt that, because the children in this school were of a highly impressionable age, it was essential that this building should demonstrate a range of building solutions which would be useful and appropriate to the overall building needs in the area, and unlike many of the public buildings in Alashtar, not reinforce the rejection of the available building methods by only using materials and elements brought into the area from the city.

The kindergarten (Fig. 6) required two large teaching spaces, both approximately 7 metres by 7 metres. The local method of roofing used timber beams to support a flat mud roof. These beams effectively limited the width of rooms to 3.5 metres. In every case that a larger space

Fig 6 KINDERGARTEN PLAN, ALASHTAR



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had been required, steel beams and jack arches had been used for the roof, often using a steel truss to support longer spans. This was an obvious restriction on the use of local materials. To overcome this each of the classrooms used a different method to permit the large roof area to be covered by local materials. The middle of one of the classrooms was spanned by a large 6.5 metre wide brick arch, which supported the timber beams spanning across to the extrenal walls of the room. This arch was the largest to be built in the area, and demonstrated another use that arches could be put to. Previously arches had only been used to span across window and door openings. The other classroom used a timber truss to support the beams. The truss was made in the local wood working shop.

The open spaces within the kindergarten contained covered arcades which provided playspace in the winter. These arcades used a combination of arches and timber beams to support the flat roof.

Low level windows openings were spanned by arches, high level openings, for light and cross ventilation, used timber lintels, connected to ring beams (the latter as an earthquake resistant precaution.)

A small space in the centre of the building, forming the entrance to the teacher's office and cloakroom, was, at the suggestion of the builders, covered with a raised dome, positioned over small openings which let light in and allowed hot air to escape in the summer. The internal construction of the dome was left exposed so that one could see the materials and how they had been used.

The finished building demonstrated a variety of building

solutions, some applicable for larger spaces, some at a domestic scale. All of the building used locally available materials.

At the same time that the kindergarten was built, three houses for teachers were built nearby, using the same principles. Each house demonstrated different techniques. In the following building season, a number of dwellings were built privately in the area and made use of the methods used in these buildings.

It is important in public building, that, where possible, the new construction should stand as a model relevant to local domestic building needs. Too often, official building is at variance with the techniques available to the public.

4 Village centres

Becuase of the size of the community and the availability of teachers, in a number of settlements it was not practical to build schools: Instead, village centres were developed. These had an educational role covering more than primary education, and were established as the bases out of which the trained health, agriculture and educaton workers could operate. The buildings combined specialised space with mulitpurpose space, and were consequently used intensively all year round. A variety of these centres were built, not all of them as single unified buildings (i.e. a cluster comprising of a small clinic and school). However, most confirmed to a basic pattern developed for the area, which could be built with different materials depending on the specific location.

Each centre was usually made up of the following spaces (Fig. 7): Accomodation for one of the three trained

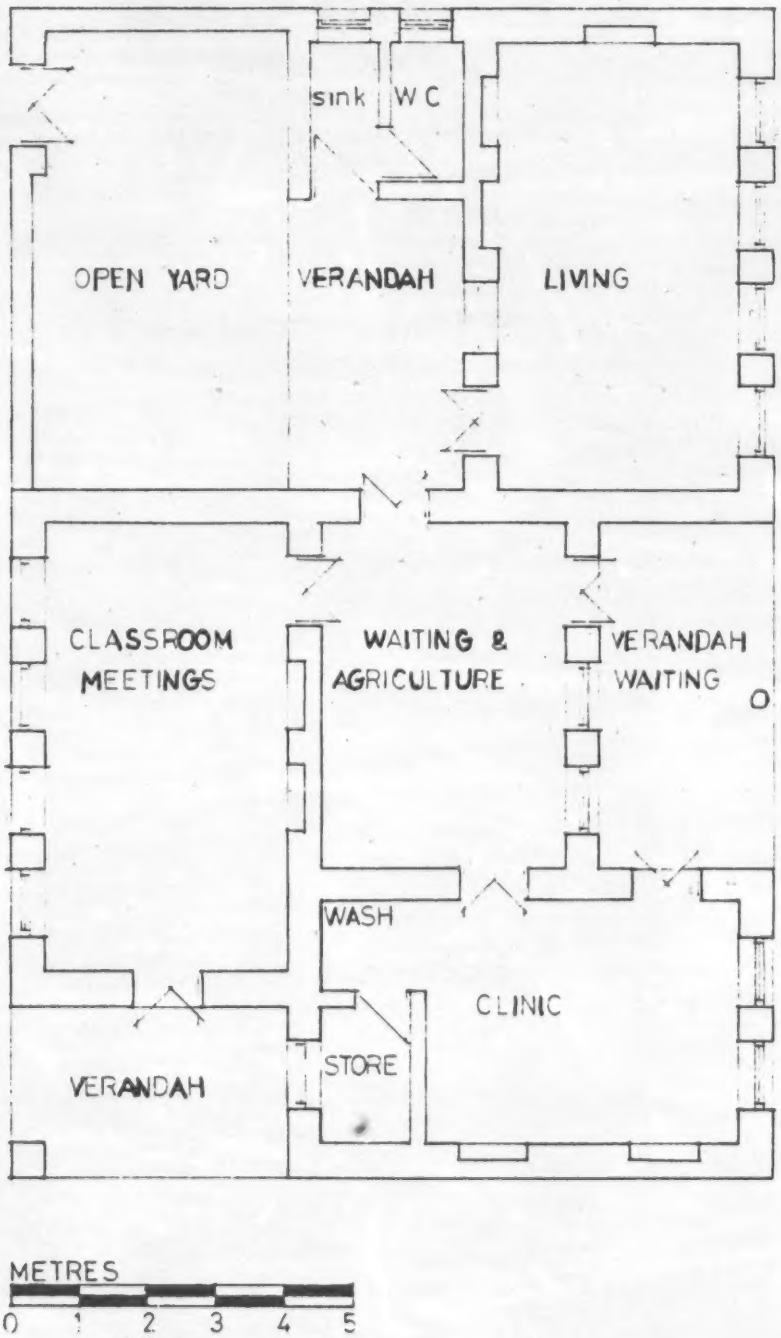

Fig 7 VILLAGE CENTRE
with accomodation

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'Font line workers', who would therefore be available in emergencies and could look after the building; connected to the accommodation, was a private courtyard and w.c. and washing facilities. At the centre of the building was a large room, opening onto a verandah at the front of the building and used as a waiting room when the clinic was open, and also as the room where the agricultural worker could dispense seed and implements as available. Adjacent to this space was a one room clinic with washing area and medical store. This was the only specialised space in the building. To the rear of the building, with separate access as well as access from the waiting room, was the classroom. used during the day for child education and in the early evenings for adult literacy classes. The classroom was also used for discussions and meetings.

In some of these centres, depending on the activities of the community, an agricultural store was added. In others, the accomodation was omitted and additional space provided for teaching/assistance. In those cases the 'Front line workers' lived nearby in their own house. (Fig. 8)

Whilst containing certain specialised spaces, these centres were essentially developed from the local style of housing. In all cases, the community participated in the building process, and the variations in design reflected the differences in local situations. In some cases, a particular space was omitted where the villagers felt that a room was already available for that specific activity nearby in the village. One of the main advantages of these centres was the process of exposing individuals to different activities relating directly to their lives. Academic education became more directly related to events, conditions and needs in the community.

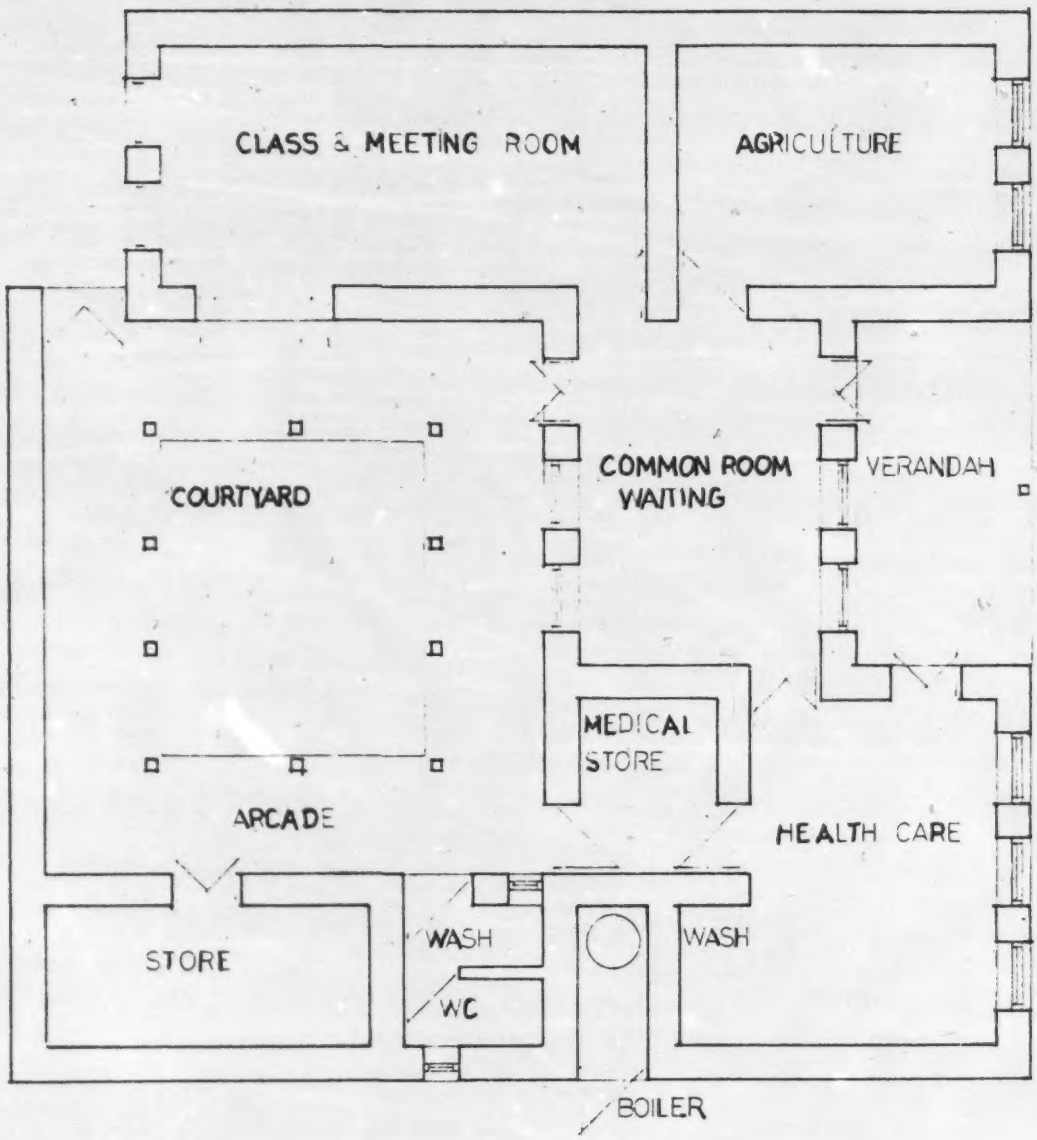

Fig 8 VILLAGE CENTRE
no accomodation ; includes agricultural room / store

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5 Water supply and Public Bath building in Serab Seid Ali

Many of the settlements in the Selseleh Region had no facilities at all. The process of organising the public facilities in Serab Seid Ali (Fig 2.) was characteristic of other villages in the area. In this village the S.I.D.P. assisted in the provision of a water supply and a public bath. The choice of facilities was made by the village. However, the public bath (Hamam) is traditionally not purely a place for washing but is directly related to the health of the village. In the past, medical assistance was found in the public bath, provided by the village barber. The public bath also provided a warm convivial atmosphere for meeting and talking, and hence played an essential social role in village life, particularly for the women.

In the spring of 1979 the 'front line worker' from Serab Seid Ali came to the S.I.D.P. staff and requested that the village water supply should be improved. At the time water was carried by hand from a spring 1 km distant from the village. The labour involved was considerable, but additionally sheep and goats were polluting the water at the source. The amount of water coming from the spring was considerable but nearly all of it flowed unused into the river at the bottom of the valley (Fig. 9).

We visited the village to get a clearer understanding of the situation and by talking to the villagers, found out what was really needed and what resources were available. This village was extremely poor, situated on marginal agricultural land on the hillsides where little more than subsistance was possible. The majority of able bodied men had moved away to Tehran or Isfahan where the job opportunities were better. In effect the village was made

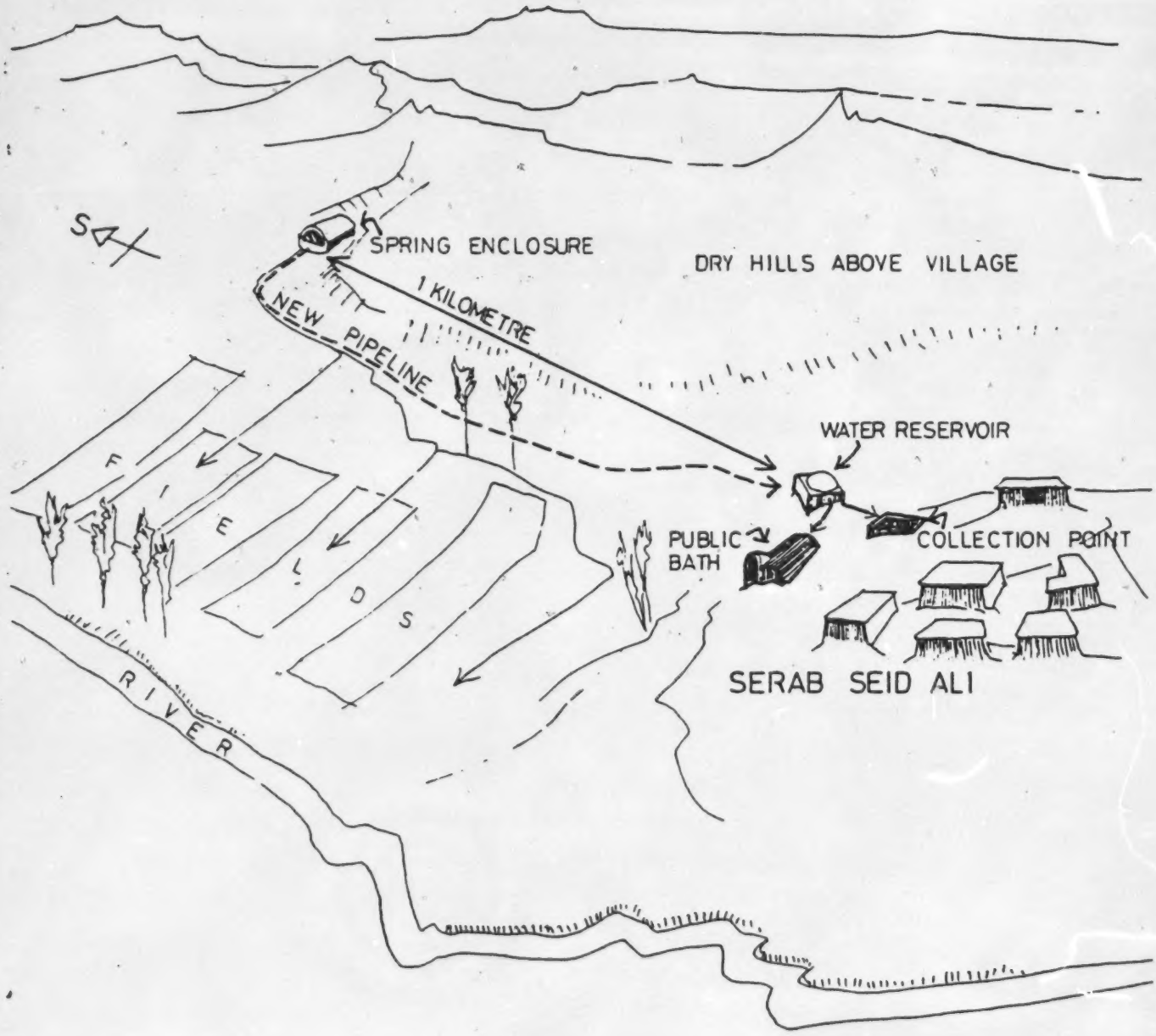


Fig 9 DIAGRAMMATIC LOCATION OF NEW FACILITIES IN SERAB SEID ALI

up of women, children and old men, who received money from the men working in the cities. There was practically no cash available for donation towards any public activity. We explained to the villagers that there had to be some sort of contribution from them if they expected to get assistance from the S.I.D.P.

It was necessary to find out who would be available or capable of working on a building project, and in basic labouring jobs, since this contribution by the village could help to offset some of the costs of any work undertaken, and be taken as payment in kind. Furthermore, in order to get assistance from the project, and through them, the Government programme, it was felt that a more wide ranging programme should be attempted, incorporating more than piping water to the village. In this way the village could contribute more in labour and materials, and there would be more money available in terms of matching funds from the Governemtn.

We asked the village to select what sort of facilities they would like, if the resources were obtainable, and what order of preference did they give to these facilities. The villagers collectively decided that the most immediate need was for a public bath house. This choice had advantages; the building was directly linked to the water supply project, and represented a possible source of income and prestige to the village, since people from neighbouring villages could come and use the bath, and help to pay for its upkeep. The village already had access to a rudimentary primary school in a neighbouring village. Five old men and two boys volunteered to work on the scheme. No one else was available. The S.I.D.P. agreed to provide the skills required, and those materials not readily available near the village.

Practically, the first step was to enclose the spring sufficiently enough to provide a head of water for supplying the pipe, and to stop animals contaminating the water before it was piped. At the same time, water had to continue to supply the fields below. Only a small part would be taken to the village. A simple stone shelter was built round the spring, with a vaulted brick roof. At the lower end was a low wall acting as a dam, through which a pipe passed into the reservoir behind. Any water not taken into the pipe flowed over the top of the wall and was channelled down into the fields below for irrigation. Below the wall the pipe was laid in the side of the existing water source, to save excavation. Only when it approached the village did it deviate from this route. Because the route the pipe had to follow was not straight, plastic pipe was used, which was also cheap and simple to assemble. No heavy equipment was required. The pipe was buried to protect it from the sun. At the village end, a small 3 metre square reservoir was built of stone, collected locally, with a domed roof, using brick brought from one of the new local kilns. The reservoir was needed if both drinking water and bathing water could be drawn off at the same time. One pipe fed from the reservoir to a water collection point and dish/clothes washing area. Another pipe fed the bath, built slightly down the hillside from the reservoir. The bath house itself was built dug into the hillside, so that the minimum of walling material would be required to support the roof, the bath would not lose heat to the cooler outside air in winter and water required only gravity to carry it through the bath. The hot water boiler room was built above the main bathing room. The bath also incorporated a public lavatory. (Fig. 10)

Because the vilage was poor, the building was orientated to allow the use of solar collectors on the roof, so that

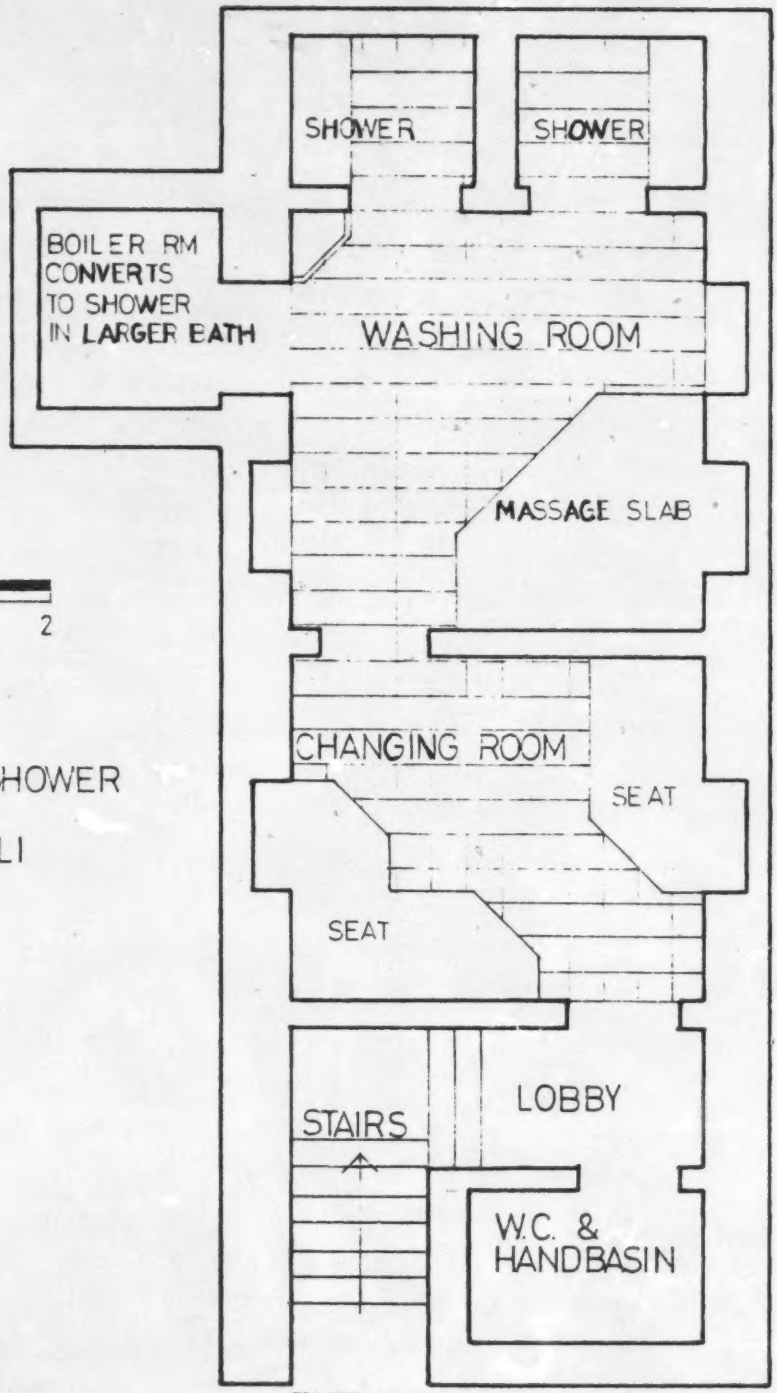
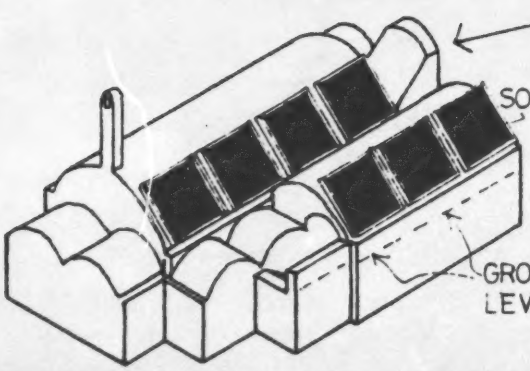


Fig 10
PLAN. TWO SHOWER
PUBLIC BATH
SERAB SEID ALI



ISOMETRIC OF EXPANDED PUBLIC
BATH WITH SOLAR COLLECTORS

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the water could be heated by solar energy for up to 6 - 7 months of the year and reduce fuel costs.

The whole of this programme was completed at extremely low financial cost. All of the labour, including the excavation for the bath, came from the village. This would otherwise have greatly increased the expense of the building. Many of the materials came from nearby; sand was delivered by tractor and trailor from a river 3 kms away; line came from a kiln 6 kms away, and was used for the mortar; most of the stone was collected locally; very little cement was used, except where bitumen was being applied as a damp proof course in the buildings. The bricks used on the roofs were produced in local kilns.

In the process of building the bath, trainee builders were employed to gain experience in the process, and the team developed from this village moved on to build a similar bath in another village in the area, but this time with much less supervision.

In financial terms, the amount of labour expended on the work would have made the scheme prohibitively expensive, but labour was the main resource that the village could offer and had the time to do so, especially during off seasons when not required by agriculture. The villagers now run the bath independantly, operating it on the days that they choose. They recognise that these facilities are there primarily through their own effort, and are consequently their responsibility.